T H E S I S F O R T H E D E G R E E O F M. D.

o n

SMALL-POX: ITS DIAGNOSIS AND PUBLIC HEALTH ADMINISTRATION.

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by

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Prefatory Note.

The following Thesis, written under considerable pressure of time, is based on my work, as Assistant to the Medical Officer of Health for Glasgow, during the last two years. References to the work of others have been as far as possible avoided, in order that the work should reflect my own experience.

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The administration of infectious disease is unquestionably one of the most important duties which the Medical Officer of Health is called upon to discharge. Indeed, to the general public, not only does it appear his most obvious duty, but may even seem to be his only one - so largely does this branch of work bulk in the public estimation. And for the M. O. H. himself, the administration of infectious disease has peculiar attrac--tions. So complex and varied are the questions which come before the notice of the M. O. H. in the course of his daily work, and so far removed are many of them from the purely medical side of his training, that frequently with a sense of relief, he turns from such questions as sewage disposal, building regulations, etc. etc., to a study of the infectious diseases. In this sphere of labour he finds subject matter which is highly congenial to a mind trained in medicine, and he is brought face to face at once with something which has a most direct bear--ing upon the public health. However much he may be interested in disease in general, the infectious diseases, owing to their power of spreading from person to person, and thus from district to district, must always claim a large share of his attention. Whilst it is perfectly true that the prevalence of infectious disease in a community cannot always be implicitly be relied upon as indicating any specific hygienic defects in its armament, still in many instances the connection between an epidemic and some definite breach of the laws of hygiene can be only too apparently demonstrated. To some extent, but to that only, the M. O. H. can look upon the prevalence of a particular infectious disease as indicative of a

weak/

weak point in his administrative measures for the preservation of public health.

However true that may be, infectious disease has for him a peculiar value. In investigating any particular outbreak, enquiring into its causation and the circumstances which tend to encourage its spread, the M. O. H. acquires at first hand, a minute knowledge of the social and sanitary conditions under which the people live. The importance of such a knowledge, it is perfectly obvious, can hardly be over-estimated.

Not only does infectious disease acquire an importance in this regard, but it also acts as the agency whereby the official responsible for the public health as a whole, is brought into touch with the general practitioner whose attention is naturally confined to his individual patients. The relation so established is of the greatest moment to the public welfare, and it is the duty of every M. O. H. to cultivate cordial relations with the medical practitioners of the district. A great deal of mutual aid may thus be rendered, and the most beneficial effects will follow, not only to the profession, but to the general public.

Small-pox occupies a unique position in the category of infectious diseases. Its importance from a public health point of view is not only due to its ravages in the past, to its well-known infectivity which seems to set racial and social distinctions at defiance, but to the fact that it has been rendered the disease which is most susceptible to proper prophylactic measures. One of the greatest scourges the world has ever seen can now, thanks to vaccination, be largely deprived of its formid-able characters. Whilst this wonderful triumph of

medical/

medical science can never be too highly extolled, it is lamentable, on the other hand, to see the indifference with which it is treated by a general public who owe so much to it.

There is scarcely anything more depressing than to see the country which gave birth to this great dis--covery, falling sadly behind other nations, in the use which they make of it.

Signs are not wanting, however, in the shape of outbreaks in one large town after another (Glasgow, and now London, to mention no further examples) to show that a Nemesis is surely overtaking those communities which, in largely ascribing their freedom from Small-pox to improvements in general sanitation, have become careless regarding vaccination; fulfilling the letter, rather than the spirit of the vaccination laws. It seems not an inopportune moment, therefore, to enquire carefully into the lessons which recent experience of the disease on a large scale has taught us.

The plan which will be adopted in this paper is to follow the various steps which are taken by the M. O. H. to cope with an outbreak of Small-pox. Written entirely from the point of view of an M. O. H. it will deal with Notification of the disease before the Diagnosis, as notification is the means whereby that official becomes aware of the existence of the disease. Then assuming that the M. O. H. has received a communication calling his attention to a suspected case of Small-pox, the Diagnosis of the disease can be fitly considered at the point where it confronts the M. O. H.

Those methods of procedure which are common to

the administration of infectious disease in general, such as disinfection, will be but briefly considered, unless some which are subject to special modification in dealing with Small-pox, thus, the policy pursued with regard to Notification. On the other hand every special effort directed towards the extinction of Small-pox will be considered at some length, its value discussed, and various suggestions as to need for amended legislation will be put forward.

N O T I F I C A T I O N.

The Infectious Diseases (Notification) Act, 1889, originally adoptive outside London, has been made compulsory throughout Scotland by the Public Health (Scotland) Act, 1897, Section 44, and more recently the same end has been accomplished for England & Wales by the Infectious Diseases (Notification) Extension Act, 1899.

This most valuable Act supplies the machinery whereby the M. O. H. becomes aware of the presence of Small-pox (as well as the other notifiable diseases) in his district. The obligation to notify is laid upon two classes of people. (See Section III, 1, (a) and (b),

(1) the head of the family to which the patient belongs; or the nearest relatives present or in attendance, or any person in charge of or in attendance on the patient, or the occupier of the building,

(2) every medical practitioner attending on or called in to visit the patient.

Generally speaking the Act has become a dead letter as regards the former class, the notification being almost entirely made by the medical practitioner. But though this is true in general, an exception must be made in referring to the poorer classes, especially in times of epidemic prevalence of disease. Under such circumstances it is a comparatively common occurrence for the M. O. H. to receive written or verbal notice of the existence of Small-pox from non-medical sources. No doubt such notification cannot, so far as accuracy is concerned, have the same value as a medical certificate, but it is perfectly legal on the one hand, and there are reasons/

reasons why even special attention should be paid to it, on the other. Lay notifications of infectious disease emanate almost entirely from the poorer districts, where the population is housed in densely-packed tene--ments which provide every facility for the rapid spread of the disease. On this ground therefore, the M. O. H. will do well to closely investigate and verify personally, if possible, every such notification. As a variety of the ordinary notifications by lay persons, may be mentioned the anonymous note which every M. O. H. is certain to receive. More or less illiterate notes calling attention to suspicious illness in certain families, and signed "A Tenant," "A Neighbour" etc., will no doubt find their way to the Health Office during an epidemic.

As neither the precise person nor the disease is frequently stated, such communications can hardly be termed legitimate notifications. Yet it would be an extremely unwise policy to utterly neglect such notices. The true policy to be pursued is to lay aside altogether the question as to the authorship of the note, and con--fine one's attention entirely to verifying the informa--tion imparted. Many a time during the recent epidemic in Glasgow have hidden cases of Small-pox been brought to light through this agency.

It may be briefly mentioned here that in addition to the obligations enforced by the Infectious Diseases (Notification) Act, special reference is made in the Public Health (Scotland) Act, 1897, Section 97, and the Public Health (England) Act, 1875, Section 84, to the keepers of Common Lodging-houses, as being under the/

the necessity of at once reporting any case of fever or infectious disease.

Dealing now with the question of notification by the medical attendant:- when a definite certificate of Small-pox is given, it is at once accepted and the necessary action taken. But at the beginning, at least, of a Small-pox outbreak, it will generally be found that many practitioners have never seen a case, and therefore may be justifiably chary of sending in a definite certificate. In better-class practice, this difficulty can be got over by calling in a consulting physician in a doubtful case. Amongst the working and poorer classes, the medical attendant will not be able to fall back upon this resource, and the readiest way out of his difficulty is to communicate his suspicions to the M. O. H. and request a consultation. Whilst not de jure, the M. O. H. is de facto, the consulting authority on infectious diseases, in his district. At least this is the light in which he is regarded by the general practitioners in Glasgow. And it is not unnatural to expect that the official under whose supervision the whole organisation of the local authority for dealing with infectious diseases lies, should possess a more extensive knowledge of these than can generally be acquired by the general medical practitioner. Hence the greatest importance must be attached to a thorough course of instruction in infectious diseases, in the training of a M. O. H. for his responsible position.

As it is an urgent necessity that a Local Authority should have information regarding cases of infectious disease without loss of time, it is obviously its/

its duty to encourage notification.

Small-pox is a very variable disease in appearance, in a populace which has largely practised vaccination. In many cases the symptoms are so mild, and the eruption so sparse, that it requires no small amount of courage for a practitioner to maintain a diagnosis of Small-pox in the face of active opposition from the patient and his family.

When added to this opposition are his own inward misgivings, arising from his imperfect acquaintance with the disease, it is not to be wondered at, if he calls the disease Chicken-pox, and takes no further action. That such a course has been followed more than once during the recent Glasgow epidemic, there is abundant proof, and the results have been disastrous.

To avoid this, it is important that the M. O. H. should make the practitioner aware, by circular or otherwise, that certificates such as "Suspected Small-pox," "Small-pox?" etc. etc., will be honoured alike with definite ones, and that he is ready to consult with any one in difficulty. Further than that, it would be well to add temporarily to the list of notifiable diseases, Chicken-pox. By these two methods, as well as by encouraging the notification of any suspicious illness, accompanied by an unfamiliar rash, (to include Haemorrhagic Small-pox) the Local Authority is likely to obtain early and accurate information regarding cases of Small-pox, which would otherwise have been neglected.

General practitioners find it of the greatest benefit to have their opinion fortified by that of the official in whose hands the further administrative action regarding/

regarding the patient, lies. And it is of no small importance to have a case at once decided upon as regards isolation, than to have it left at home for observation under conditions which make the patient a source of great danger to the other inmates of the dwelling. Hence the encouragement of notification of doubtful cases, and the willingness of the M. O. H. to consult upon such, is beneficial alike to the community and to the general practitioner.

Assuming then that the Medical Officer of Health has been called in to decide upon a suspected case of Small-pox, we have now to consider

The Diagnosis of Small-pox.

THE DIAGNOSIS OF SMALL-POX.

It is not proposed here to give a full clinical description of all the varieties of Small-pox, as that would fitly form a treatise in itself. The object is rather to show the various points which are of value in differentiating Small-pox from other diseases.

Inasmuch as an eruption of some kind or other is generally present in Small-pox, the diagnosis is, as a rule, a matter of very little difficulty. But cases nevertheless frequently occur in which the greatest experience of the disease, and the acutest powers of observation, will scarcely suffice for the accurate recognition of the disease. In a community which has practised infantile vaccination, Small-pox will be found to vary in severity to a most extra-ordinary degree. Sometimes simulating a passing indisposition, at other times, it is a rapidly fatal illness. On account of the infinite degrees of modification due to vaccination, and also on account of the comparative frequency of various prodromal rashes, the diagnosis is often a matter of the greatest difficulty. Not only so, but in pure haemorrhagic Small-pox, the observer sees nothing resembling the ordinary variolar eruption, and may be completely at a loss.

Experience has shown clearly that errors in diagnosis of this and any other disease, generally arise from two causes:-

First, an incomplete examination of the patient.

Second/

Second, a tendency to be unduly influenced by the presence of an eruption, and to forget the other clinical features.

The illness begins suddenly with shivering, headache, pain in the small of the back, nausea or vomiting, and fever. These symptoms are generally explained by the patient as "a bilious attack," "influenza," "a cold," and such a description is often backed up by the statement that he has fre-quently had such attacks before. During this stage various domestic remedies are apt to be used (sulphur and whisky being the favourite) and the subsequent appearance of the eruption is attributed to them. The eruption itself is generally stated to be exactly what appears whenever the patient has a bilious attack or a cold. Such statements, made often bona fide, and with great emphasis, are calculated to mislead the medical attendant, especially when the eruption is very sparse. A striking clinical feature is the disappearance of the symptoms of invasion after the eruption has come. In twenty-four hours the patient feels very much better, and it is hard to convince him that this apparent improve-ment is in reality part of the disease. It is a common experience to find that the patient, feeling perfectly well, has resumed work, and in a modified attack may never feel anything further wrong with himself.

As a rule, the symptoms of invasion are severe in proportion to the gravity of the attack, but I have frequently seen the suffering intense, with/

with a temperature of 106° F.,, and yet the case after--wards prove to be a mild one.

The eruption is generally the great feature of the disease, and is only too apt to absorb all the observer's attention. Before dealing with the ordinary variolar eruption, it may be well to describe some of the prodromal rashes, which are apt to prove so puzzling.

As a class, they present a different dis--tribution from the true variolar rash, inasmuch as they are most frequently found on the trunk, and least on the face and limbs.

The scarlatiniform is most frequently met with. It presents itself as an erythema of varying intensity, which is generally less punctiform than that of the Scarlet Fever rash. Indeed, it is usually a fine uniform blush extending all over the trunk, especial--ly the lower part, and may also be present on the limbs. In many instances, it may only be made apparent by the blanching of the skin when pressed by the fingers. This eruption is often persistent after the papular rash has appeared.

The petechio-erythematous prodromal rash is of common occurrence. In distribution, it is as a rule, much more limited than the preceding, its seat of election being a triangular area whose limits are as follows. A line crossing the body above the iliac crests, and joined at each extremity by two starting about four inches below the pubes and passing upwards and outwards to meet the first. It therefore includes the lower part of the abdomen, the groins, the upper and inner aspects of the thighs. This triangular

shape/

shape is generally adhered to, but I have seen con-
-siderable variations: in one instance the usual
oblique boundary on one thigh was seen, whilst on the
other, the rash was limited in a definite manner by a
line passing transversely round the thigh. In
addition to the principal site, the rash is also found
occasionally extending up the flanks, at the axilla,
at the bend of the elbow, behind the knee.

It consists of a rather coarsely-punctate
erythema with petechiae, generally bright-red, scattered
throughout it. This rash owing to the presence of
petechiae, is apt to be mistaken for haemorrhagic
Small-pox.

When at all well-marked, and characteristically
distributed, this rash is of the greatest help in the
early diagnosis of Small-pox. As a rule, it is more
common (and this seems true of the other prodromal
eruptions) in favourable cases. It is also the one
which is least likely to be mistaken for any of the
exanthemata.

A third rash, not generally described, has
been of common occurrence during the recent epidemic.
Being far from conspicuous, it is apt to be overlooked.
It consists of a fawn coloured blush over the lower
part of the trunk, being more intense over the
hypogastric and sacral regions. Apparently it is of
vasomotor origin, as it fades under pressure by the
fingers.

The fourth variety, the morbilliform, is of
less frequent occurrence than the three preceding, and
is more likely to cause mistakes to be made.

The/

The measly eruption appears on the trunk, is pink in colour, very little elevated, and generally presents the irregular groupings of the true Measles eruption. Its distribution varies, being often of limited extent. On fading, it does not leave the characteristic Measles staining.

The prodromal eruptions as a whole appear from the second day of illness, and not infrequently persist for some days after the appearance of the papular eruption.

The following case illustrates the difficulty presented by a prodromal rash.

A man took ill with headache, shivering and fever, pain in back. When seen by me, his face highly flushed, showed some three papules, and over the body and limbs was a rash which closely resembled Measles. He was sent to the Small-pox Hospital, and being con-sidered Measles by the Visiting Physician, he was re-vaccinated and isolated. In twenty-four hours, the rash entirely disappeared, and the true variolar rash, very scanty, came out.

The ordinary variolar rash generally appears on the third day of illness, its later appearance usually indicating a mild attack.

It consists of small red-roundish papules, distinctly elevated above the general level of the skin, and hard and resistant to pressure (the "shotty" feeling). On lightly passing the hand over the skin, the papules feel smooth and velvety. By their decided elevation, and by their resistance to pressure, they are distinguishable, in most cases, from the rash of/

of Measles.

In number they vary enormously: sometimes being so closely set, especially on the face, that it would be difficult to put a pin-head on sound skin, at other times, the whole eruption on the skin may be a dozen, or fewer spots. I have come across cases in which from the symptoms of invasion, as well as from the association with infection, there could be no reasonable doubt of Small-pox, and yet the total cutaneous manifestation was one and two elements.

Whether confluent or discrete, the eruption generally has a certain distribution. It appears first on the face, neck and scalp, then on the arms, especially on the lower part of fore-arms and back of wrists, next on the trunk, and lastly on the lower limbs. Roughly then, it exhibits a gradation in point of time, from the face downwards. Whilst this law holds true in most cases, it is not infrequent to find the eruption in as advanced a stage on the lower part of fore-arms, as it is on the face. All the elements in a given area of skin come out within a short time of one another, yet they are not exactly simultaneously in their appearance. Palpation will as a rule detect numerous elements in addition to those already apparent to the eye. The elements in a given area closely approximate in stage of development and size, although an occasional one here and there, may not only be larger, but further advanced.

The variolar eruption shows a decided pre-ference for certain parts of the skin. It is most profuse/

profuse on the face, next on the limbs, and least on the trunk; being the reverse of the prodromal eruptions in distribution. It will also be found more marked on the fore-arms than the arms, showing a tendency to accumulate over the lower part of the forearm, the wrist and dorsum of hand. On the lower limbs, a similar tendency to profuseness will be met with near the ankle. The eruption also affects the palms and soles. Coincident with the appearance of the rash on the skin, the palate may present a diffuse catarrhal congestion, or papules to a variable number may also be dotted over it.

So long as only the number and further development of the papules are the modifying effects of vaccination observed, no great difficulty in diagnosis will be experienced:- the small-pox papule being fairly characteristic. But cases will be met with where the papules are not only few, but very much reduced in size, perhaps never at any time exceeding a pin's head. These closely resemble the various acneiform papules so commonly found on the skin.

The comparative sparseness of the eruption on the trunk, is a point of considerable value in the diagnosis of Small-pox, yet when the eruption as a whole is very scanty, it may be impossible to guage accurately its relative frequency on trunk and limbs. After some three days, the papule which has meantime been growing more pronounced, becomes converted into a vesicle.

In very much modified Small-pox this trans-formation may either not occur or be very imperfect: the/

the eruption aborting at this stage. The Small-pox vesicle is generally rounded in outline, and flattened on the top. Frequently a small depression is noticed on the top of the vesicle, which thus presents an umbilicated appearance. This umbilication is chiefly met on the trunk and limbs, but is not always present. Those who are not conversant with Small-pox are apt to attach undue importance to this appearance as being diagnostic of the disease, and further, any kind of depression presented by a vesicle, is likely to be called an umbilication. A vesicle, however produced, will, after maturity, tend to collapse, owing to lessening of tension, and this will be most marked on the top. Drying changes may accompany this relaxation, and the appearance will be something like this ⌒ a wide saucer shaped depression. The umbilicated Small-pox vesicle, on the other hand, shows a minute central depression whilst still turgid and before any sign of desiccation occurs. Its outline is rather the following ⌒

The Small-pox vesicles, like the papules are generally similar in size and appearance in any given area of skin.

From the moment that vesiculation sets in, the vesicle presents a milky appearance which becomes more pronounced with its further development. The Small-pox vesicle never shows itself as a clear trans-parent bleb. An exception of this statement, however, may perhaps be found in those extremely small modified papules already referred to, when vesiculation sets in. Here we have a small pin-head vesicle seated in the middle/

middle of a circumscribed areola, and it is not easy to say whether it be translucent or not. A further test of a Small-pox vesicle is to be found in its multi--locular character. When pricked with a pin at one point, it will not entirely collapse. This is not a safe guide, and need scarcely be resorted to, if the other characteristics of the Small-pox vesicle be kept in mind.

About the seventh day of the disease, the facial vesicles develop an inflammatory area, and gradually change into pustules.

In modified Small-pox pustulation may never be observed, the lesions drying up from the papular, or early vesicular stage. They darken as they dry, and the skin appears like that of a lizard, owing to the shining cornified plates which the modified elements form. This appearance is also met with under the thick epidermis of the palms and soles, where even pustules dry up, without piercing the epidermis or rupturing. In very slight cases of the disease, when other signs have vanished, a careful examination of the palms and soles, fingers and toes, may reveal a few small dark reddish-brown spots, not elevated above the skin, but resistant to pressure. The only thing which closely simulates these is the small ecchymosis when a finger has been "nipped" momentarily between two hard surfaces. These little "cores" remain as tell-tales on the palms and soles, long after the rest of the body has become free from eruption, and these are of great value in the detection of missed cases of the disease.

By the eighth day of the disease, the facial elements/

elements have become fully pustular, and when this stage is reached the eruption of Small-pox can not be readily mistaken for anything else. The pustules mature, exude thick honey-like pus, which forms prominent crusts. These in time become detached leaving desquamation of the intervening skin.

When the eruption has been very copious, a spurious appearance of commencing Small-pox eruption may be presented by a face which has just been freed of its crusts. The normal intervals of skin simulate papules, whilst the depression caused by the commencing cicatrisation are taken for the true skin.

In this hasty summary of the eruption of Small-pox, it is not intended to enlarge upon the course of the general symptoms of the disease. These will be referred to, as required, in dealing with the differentiation of Small-pox from other diseases.

Haemorrhagic Small-pox may be taken as a class by itself. Not only on account of its invariably fatal termination, but because its cutaneous mani-festations are so unlike those of ordinary Small-pox that it is not usually recognised; it is an important subject for study.

This form of the disease sets in with considerable violence, although the temperature is not as a rule very high. Very early, the patient assumes a characteristic "felled" look, although the intellect remains perfectly clear.

The only prodromal eruption which seems peculiar to haemorrhagic Small-pox is a violent erythema, like erysipelas in appearance. I have seen

a /

a patient covered with an eruption of this kind, the tint resembling that of a boiled lobster. The intensity of the redness was shown by the contrast offered when pressure was made by the fingers. Petechiae varying in size soon made their appearance more particularly over the trunk. They may be red or purple, rapidly increase in number, and tend to coalesce, so that the whole surface of the trunk, especially the lower part, becomes plum-coloured. Subconjunctival haemorrhages begin, and extend until the whole eye is black. Haemorrhages then set in from all the mucous surfaces, and death ensues in a few days. The tragic feature of this form of the disease, is the clearness of the intellect throughout, and patients may be asking if their illness be really serious a few hours before death occurs. As showing the difficulty of diagnosis, the following cases may be referred to.

I received a hasty note regarding a woman who had been ill some five days, and whom the medical attendant certified as Typhus? The patient was obviously moribund when seen, the face pale, and presenting no kind of eruption whatever. The arms were alike free from eruption, but the trunk was exactly the colour of a ripe plum. The eruption had been watched for two days by the medical attendant who was evidently non-plussed by it.

In another instance, with a history of two days violent illness, the vivid general erysipelatoid rash already referred to, was the only form of eruption present at the time of examination.

Cases/

Cases of pure haemorrhagic Small-pox are not, however, very common. More frequently there is a certain development of the true variolar eruption, followed later by the appearance of cutaneous and other haemorrhages. The true eruption in such cases, is generally irregular in its distribution and develop--ment, vesiculation being imperfect, and the lesions may be of a violet tint.

The comparative sparseness of the true eruption in some of these cases, and before the appear--ance of haemorrhages, may lead the unwary into giving a good prognosis. A woman of forty was found with a sparse eruption of undoubted Small-pox. Notwith--standing the fact that the eruption had come out, her symptoms of invasion continued, the temperature had not fallen, the pulse was rapid and feeble, and the patient looked extremely ill. The eruption was scanty, ill-formed, and irregular, and from a considera--tion of these points I ventured to prognose haemorr--hagic complication - a prognosis which subsequent events only too fully justified.

In some instances a pseudo-haemorrhagic character may arise, owing to haemorrhage into the ordinary vesicular elements. Such cases, are of course, of much less grave nature than the ordinary haemorrhagic.

Chicken-pox is the disease which is most commonly mistaken for Small-pox and vice-versa. Yet as a rule only a little care is required to differenti--ate the two diseases. But every now and then it will be/

be found almost impossible to distinguish the one from the other. The following general rules may be given. In Chicken-pox the general disturbance is but slight, and the eruption is often the first and only sign of the disease. Within twenty-four hours the eruption appears and is almost distinctly vesicular from the beginning. The eruption whilst frequently copious on the face, is generally most abundant on the trunk, especially the back, and least on the limbs. The elements vary greatly in size and in stage of development in the same area of skin. There is no well-marked gradation of development from above downwards, as in Small-pox. The palms and soles are mostly free from the eruption, but this is not always true in the case of older children, adolescents, and adults. The eruption comes out in crops, so that various stages of development may be seen side by side. In the earlier stages the vesicles are approximately hemispherical in shape, contrasting with the flattened vesicles of Small-pox, and are trans--lucent only becoming milky later. Pseudo-umbilication is common during the drying stage of the vesicles. The evolution of the Chicken-pox element is much more rapid than in the case of Small-pox, and crusting is present inside a few days.

Chicken-pox is generally a disease of young children, and the presence of a good primary vaccina--tion scar in these may help to exclude the graver disease.

(1) Henoch remarks that he has not seen a single/

(1) Lectures on Diseases of Children. New Syd. Soc. Vol. ii. page 69.

single well authenticated case of the disease in an adult. The disease must surely be commoner in adults in this country, as I have seen at least one dozen such cases, where there could not be any doubt regarding the diagnosis.

Measles: This disease in the early stages is often very difficult to distinguish from commencing confluent Small-pox, especially in adults. The catarrhal symptoms may not be very prominent, and the conjunctival congestion present, is similar to that observed in confluent Small-pox. In full-blooded adults with florid complexion, the Measles eruption on the face may be very distinctly papular, and simulate Small-pox closely. The Measles eruption attacks the trunk, however, before the arms and fore-arms, and on the body generally, the soft character of the eruption with its characteristic grouping will help to clear up matters. Examination of the mouth may show the enanthem on the soft palate, and Koplik spots may also be discovered. The temperature rises, after the eruption has appeared, and the patient does not seem materially benefitted by the eruption coming out. Whilst the abundant presence of the eruption on the trunk will undoubtedly help, it is quite conceivable that a measly prodromal Small-pox eruption would be mistaken for true Measles. The Measly prodromal eruption soon disappears and leaves none of the characteristic staining of true Measles.

Scarlet Fever: This can generally be distinguished from Small-pox/

Small-pox with scarlatiniform prodromal eruption, by the sore throat and enlargement of the maxillary glands, and the characteristic appearance of the tongue. There is no severe back-ache also, as in Small-pox.

The violent erysipelatoid prodromal of haemorrhagic Small-pox, can be distinguished by the absense of punctiform character, the appearance of the throat and tongue.

German Measles: may simulate the measly or scarlatiniform prodromal eruption of Small-pox, but the disease can be distinguished by the mildness of the constitutional disturbance.

Typhus Fever is sometimes rather like Small-pox; the distribution and character of the eruption, with the continuance of the fever, are points which aid in the differentiation.

Influenza. Frequently the symptoms of invasion of Small--pox are diagnosed as Influenza - quite a pardonable error, more especially as in this disease scarlatini--form and measly prodromal eruptions are met with. The prostration is very great from the beginning, however, and the absence of any papular rash confirms the diagnosis.

Syphilis. This disease is frequently mistaken for Small--pox. Its measly exanthema closely resembles that of Small-pox, whilst its papular and pustular eruptions are even closer imitations. The history of the case is/

is the great guide, there being an absence of sudden onset of violent symptoms. The papular and pustular eruptions may readily be mistaken for Small-pox, but they seldom have the typical distribution, and the eruption at any one part is generally polymorphous.

Herpes may be distinguished by the grouping of the vesicles, and their usually unilateral distribution.

Acne, may prove very puzzling, but generally the long duration of the eruption, the presence of comedones, and the absence of constitutional symptoms will clear up the difficulty. In any doubtful case the fore--arms should be examined, as they are rarely affected by Acne, but seldom entirely escape even in very modified Small-pox.

Eczema, lichen, psoriasis, prickly-heat, drug-rashes, etc. have all been mistaken for Small-pox. A careful enquiry into the history of the case, and a scrutiny of the eruption itself will generally suffice to detect these.

These are the chief diseases which have come before me, having been suspected as Small-pox by the general practitioner.

One very interesting case of Purpura haemorrhagica accompanied by severe constitutional disturbance, high fever etc. closely resembled Haemorr--hagic Small-pox. The haemorrhages, however, were mostly on the limbs, and did not show the usual charac--teristics of Haemorrhagic Small-pox. The diagnosis was confirmed post-mortem.

THE INFECTED PATIENT.

Should the case prove one of undoubted Small--pox, removal to hospital is at once arranged for. In Glasgow the practice has been (and it is well worthy of imitation) to send every patient suffering from Small-pox to the Hospital kept for that purpose. The infectivity of the disease is such that it can hardly be considered good practice to attempt home isolation. No doubt in certain exceptional instances where the accommodation is ample enough to secure the complete isolation of the patient, the rigid rule might be departed from with safety to the public. Taken over all, however, the pur--poses of public health are better served by the Small-pox patient being sent to Hospital. It is very rare indeed to find active resistance being offered to the removal of the patient. Removal under a warrant has practically never been necessary. It will frequently happen, however, that in spite of exceptional experience of Small-pox, the M. O. H. may be unable to decide at the time whether the case be Small-pox or not. The procedure adopted will then turn upon the circumstances of the patient.

In a large private house, where isolation can be properly effected, judgment may be suspended until the patient has been watched for a day or two.

In ordinary circumstances, however, delay is distinctly dangerous, and the necessity for the immediate removal of the patient may be very obvious, and yet it seems scarcely right that he should be removed to a Small-pox Hospital whilst he may not be suffering from the disease.

But in such instances, there is only one safe

rule for the public health administrator to follow, and this applies not only to Small-pox, but to suspected cases of infectious disease in general, i.e. in any doubtful case act as if it were the major disease.

Now in the case of suspected Small-pox, this presents actually less difficulty than may be met with in, say, Scarlet Fever, or Diphtheria.

A patient supposed to be suffering from either of these latter diseases may, unless the hospital has special and ample accommodation for the isolation of doubtful cases, be inadvertently admitted to a ward containing genuine cases, and may there contract the disease. If there be the slightest reason to doubt the diagnosis of Small-pox, however, the physician at the hospital will at once re-vaccinate the patient, to protect him from contracting infection in hospital, and will also isolate him to prevent cross-infection of his wards, should the patient's illness be of an infectious nature. Not content with merely scratching the arm and inserting lymph, he will repeat the process daily to make sure that the operation is successful.

The assumption here is, and it is well-founded, that a person successfully re-vaccinated the same day as he is exposed to Small-pox infection, will not take the disease.

It is obvious, of course, that the patient's safety from Small-pox will almost entirely depend on the efficiency of the vaccination. This will be dealt with later on in connection with the question of vaccination. My experience during the epidemic showed clearly that the tendency in part of the medical practitioners was to miss doubtful/

doubtful cases of Small-pox, and thus many mild cases were labelled Chicken-pox, or other diseases, and allowed to go about spreading infection.

To counteract this tendency, the task set me was to detect such mild cases, and in doing so my errors in diagnosis have all leaned to the side of caution. Better it is to send a patient to a Small-pox Hospital, where he can be protected from harm by being at once re-vaccinated, than to definitely pronounce as not Small-pox, one who might continue to spread the disease.

Removal to Hospital having been arranged for, enquiry should be at once instituted to determine,

(1) the source of the patient's infection, and

(2) the number and distribution in the district of the persons who have probably become infected from him.

Comparing the date of sickening as given by the patient or his friends, with the stage of the disease now before him, the M. O. H. is able, by assuming an average incubation period of twelve days, to tell the patient the period about which he received his infection. The hypothetical date will not infrequently recall to the patient's mind some special movements on his part about that time, such as, a visit to a particular house, etc. By subsequent enquiry at the addresses given, the M. O. H. may be able to bring to light some missed case of the disease.

Coming to the second point it is of the greatest importance to examine everyone in the house. Often by doing so, one has discovered indubitable traces of mild Small-pox in other members of the family, especially the younger/

younger ones. On enquiry it will be found that the constitutional disturbance was so slight, that no con-nection between these apparently trifling indispositions and the present attack was ever suspected.

The following instructive examples may indicate the necessity of such an examination being made.

A practitioner sends a note requesting that a sanitary inspector (!) who knows something about Small-pox be sent to examine a suspicious case. I found a woman in bed with a well marked attack of discrete Small-pox, and careful examination of the children showed that four successive mild attacks had passed unnoticed.

Attention is called to a woman who is found to be suffering from well-marked Small-pox. Her daughter, aged 20, who is supposed to be quite well, displays an eruption of Small-pox very mild of about three weeks duration. The nature of the illness was never suspected, the few spots being attributed to "the blood being out of order."

A school-girl of 8 develops a very mild attack of Small-pox, and in turn infects her sister with a more severe attack, this latter having no need for medical attendance continues at work, and infects a unvaccinated friend with an almost fatal attack. It was only in tracing the infection of this last case that the two earlier ones were brought to light.

Enquiries are also made as to the following particulars.

(1) Date when patient left work after sickening.

(2) Places of employment of the other members of the infected house.

(3) Names and addresses of all who have visited the infected house, or of whom patient, or any member of the household has visited since he sickened,

(4) Name of school attended by any child in house.

Having secured this information, the M. O. H. urges upon the household, and all "contacts" to protect themselves by being at once re-vaccinated. Generally speaking, so far as Glasgow is concerned, he will have little difficulty in persuading the patient's family to consent, as they have the disease before them to convict the hesitating, but it is a widely different matter dealing with the less intimate "contacts," such as occasional visitors, or neighbours in the same tenement.

Leaving for the moment any further consideration of the measures adopted outside the household, we may study the procedure involving the infected family and house.

THE INFECTED FAMILY.

Immediate vaccination of any infant, and re--vaccination of every one above 5 years, in the house, having been accomplished, the subsequent steps taken are modified, by the circumstances of the particular case.

In a large and well appointed house, where the inmates are of cleanly habits, and the disease has either been recognised early, or if late, the patient has been confined to his room since the onset, it is sufficient to advise a complete bath and change of clothing. All the infected clothing being taken away for disinfection, along with the patient's bedding, etc., the house is disinfected in the manner afterwards described.

But in many cases disinfection of the house and clothing cannot be accomplished whilst the family remain at home. Thus, the house may be, and often is, a single apartment, and frequently there is no change of clothing, let alone bathing facilities. In such cases, and also where a family refuses re-vaccination, removal to the reception house in an ambulance is indicated.

To accomplish this it will rarely be found necessary to put into force the legal powers for removal which the various Acts referred to in the following Section, place at the disposal of the Local Authority.

As a valuable factor in public health administ--ration, the role of the reception house is a peculiar one, and well worthy of study.

THE RECEPTION HOUSE.

This institution is of Glasgow origin, the first one having been opened in 1872. At first it was intended for the use of the poor people from whose house a case of Typhus had been removed. In it, they had their body surfaces freed from infection by bathing, their infected clothing taken away and others meantime supplied, whilst the sanitary staff were at work fumigating, white-washing, and generally purifying the filthy infected den from which they had come. Later, its use was extended to include the retaining of such people who were in all probability incubating Typhus, until the maximum incubation period had been safely passed.

Originally used in connection with Typhus, the reception house has latterly been of service in dealing with Small-pox and Bubonic Plague.

No statutory powers to remove and detain "contacts" in the reception house were conferred until the passing of the Glasgow Police (Amendment) Act, 1890:- the following being the Section referred to.

GLASGOW POLICE (AMENDMENT) ACT, 1890, - SECTION V.

"When infectious disease exists or has existed in any overcrowded house, or in any house occupied or used for the purpose of sleeping in by persons in excess of the numbers allowed by this Act, which cannot, in the opinion of the Medical Officer be thoroughly cleansed and disinfected while the inmates continue to reside therein, or in any house the inmates of/

of which are unable to provide themselves with clothing or bedding which is clean and free from infection while their clothing or bedding which has been exposed to infection is being washed and disin-fected, any Magistrate may on the application of the procurator-fiscal or sanitary inspector, on production of a certificate signed by the Medical Officer of Health that the removal from the said house of all the residents therein who are not suffer-ing from infectious disease, is necessary to pre-vent the spread of such disease, grant warrant to remove the said residents to the reception-house provided by the Police Commissioners, who shall accommodate and maintain such persons therein for such period, not exceeding fourteen days, as the Medical Officer may consider necessary for the public safety, and such warrant shall be sufficient authority for any officer of the Police Commissioners to compel the removal from the said house of the residents therein to the said reception-house, and to prevent the return of any of the said residents until the said house, with all their bed and body clothing, has been cleansed and disinfected to the satisfaction of the Medical Officer or Sanitary Inspector."

Glasgow Police (Amendment) Act, 1890, Section VI. provides for the maintenance of the reception-houses which had been in existence for some years previous to the passing of the Act.

So valuable was the aid rendered by the Recep-tion House in dealing with infectious disease, notably Typhus and Small-pox, that by the Public Health (Scotland) Act/

Act, 1897, its services were made available to all Local Authorities in Scotland.

Public Health (Scotland) Act, 1897, Section 47, Sub-section 4.

"If the Local Authority deem it necessary to remove from any house, or part thereof, or from any tenement of houses, all or any of the residents not being themselves sick, on account of the existence or recent existence therein of infectious disease, or for the purpose of disinfecting such house or part thereof, they may make application to a sheriff, magistrate, or justice, and the sheriff, magistrate, or justice, if satisfied of the necessity of such removal, may grant a warrant authorising the Local Authority to remove such residents, and ignoring such conditions as to time and otherwise as to him may seem fit. Provided always that no such warrant shall be necessary when the removal is carried out with the consent of any such resident or his parent or guardian. The Local Authority shall, and there are hereby empowered, to provide temporary shelter or house accommodation, and, if necessary, maintenance, with any necessary attendants, free of charge, for such persons while prevented from returning to such house, or part thereof."

An important point of distinction between this general Act and the Police Act, consists in the removal of the restriction to fourteen days, which is the maximum period of detention allowed by the Police Act.

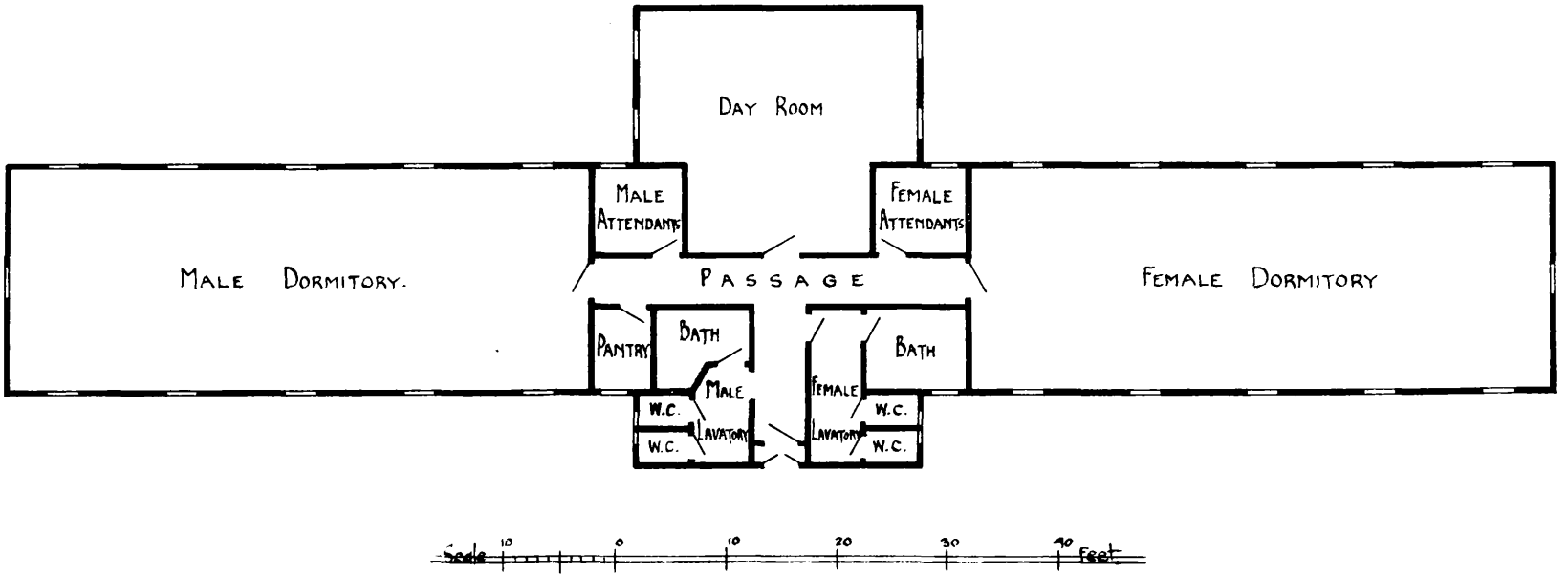
Public Health (Scotland) Act, Section 66, (1), confers upon Local Authorities the power to provide and maintain hospitals for infectious diseases, and houses of reception for convalescents from infectious disease, and for persons who have been exposed to infection.

By their adoption of the Infectious Diseases (Prevention) Act, 1890, Local Authorities in England and Wales, and Ireland, may avail themselves of the powers conferred by Section 15.

> "The Local Authority shall from time to time provide, free of charge, temporary shelter or house accommoda-
> -tion with any necessary attendants for the members of any family in which any infectious disease has appeared, who have been compelled to leave their dwelling for the purpose of enabling such dwelling to be disin-
> -fected by the Local Authority."

No power, however, is given to the Local Authority for compelling removal to the reception-house, nor for the detention therein of the "contacts" for any specified period.

In these respects the Scottish Acts show a distinct advance upon the English Law.


DAY ROOM
MALE ATTENDANTS
FEMALE ATTENDANTS
MALE DORMITORY.
PASSAGE
FEMALE DORMITORY
PANTRY
BATH
MALE
W.C.
LAVATORY
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The Glasgow reception-houses are simply old mansion houses roughly adapted to their present use. Lately, in the vacant ground attached to one of them, a pavilion has been erected which is much more suitable. A reception house for Small-pox contacts should be built upon the dormitory principle: due provision being made for the proper separation of the sexes. That this is absolutely necessary has been shown by the experience of the recent epidemic. The "contacts" frequently belong to the lowest stratum of society, and are apt to show their contempt for decency, to say nothing of propriety.

There should be separate dormitories for males and females, with proper bath and W.C. accommodation for each. A room might with advantage be set apart for use as a nursery, and another as a playing room for the older children. A large hall will serve alike for dining room and sitting room. It is of the greatest importance that there should be one or more baths specially set apart for the use of the "contacts" on entering, so that they may join the rest of the occupants in a cleanly condition of body.

Constant vigilance will require to be exercised in order to keep down vermin, scabies, etc., nuisances which are not always got rid of by the initial bath.

The house should be placed under the charge of a matron who has had a thorough training in infectious diseases, and for the double purpose of attending to the heating by steam and maintaining discipline, it is advisable to have a male official in residence.

On entering the reception-house, each "contact" has a complete bath and receives a complete change of clothing./

clothing. The infected articles are at once despatched to the sanitary wash-house for disinfection. This is generally accomplished within twenty-four hours, so that those in employment are able to resume their work in their own clothes without risk to their fellow workers. As no undoubted evidence exists to show that Small-pox is infectious during the incubation period, no restriction need be put upon the inmates as regards their intercourse with the general community. They must at least sleep in the house, and as the temperatures are taken nightly by the matron (who has been trained in fever nursing) the first indications of the onset of the disease are readily ascertained.

Medical examination speedily follows, and if necessary the 'contact' now a patient, is removed to Hospital. After a detention of at least fourteen days, the 'contacts are allowed to return to their homes, which have meantime been disinfected.

It is of the greatest importance that reception-houses should be placed in the industrial districts of the town, so that the inmates may readily have access to their employment. As the inmates are free from infection, nothing is to be gained by placing reception houses on the outskirts of the town. Indeed any objection which could be urged, would be of a sentimental or aesthetic nature. Still it is obviously undesirable to wilfully interfere with the amenity of a residential district by planting in its midst a house which will be occupied from time to time, by people whose out-door conduct may render them obnexious to the neighbourhood.

Frequently, the most ample reception-house accommodation/

accommodation will break down under the stress of an epidemic. It may then be necessary to confine the functions of the reception house to its original use. Instead of detaining the "contacts" for the full incuba-tion period, it may be necessary to discharge them whenever their houses and clothing are ready. In such cases it is advisable to detain them until satis-factory evidence of their re-vaccination being success-ful is obtained. This does not, of course, guarantee that they may not develop Small-pox a few days later, but it is distinctly in favour of the presumption that such a contingency is less likely to occur. Needless to remark, "contacts" dismissed on such a short period system of detention, must continue to be supervised at home until all likelihood of danger is past. As far as possible, under circumstances of pressure, it will be wise to detain for the full period all who have refused vaccination or re-vaccination.

The extent to which the reception-houses have been employed may be realised by the following figures which refer to the operations of one of those in Glasgow, in recent times. Of 1927 admitted, 48 were sent to Hospital with Small-pox.

Their value, however, is not merely represent-ed by the number of people who, sickening of Small-pox while under supervision, were promptly removed to hospital, but who, remaining at home, might have con-tinued to spread the disease. The gain to the "contacts" themselves in being speedily freed from infected surround-ings and clothing, and to the general public by the removal of possible sources of infection, has also to be reckoned.

As the inmates of the reception house generally belong to the poorer classes, who are ill-fed and cared for, it will frequently happen that illnesses of various kinds will arise during their period of detention. Whatever the nature of the illness may ultimately prove to be, its occurrence will be at once reported to the M.O.H. Naturally his medical examination will be at first directed to the recognition of commencing Small-pox. When this possibility has been clearly eliminated, and the case shown to be of a non-infectious nature, the nearest medical practitioner, who in the course of time acquires a non-official connection with the house, is called in to attend the patient. The expense incurred in this way is, of course, defrayed by the Local Authority.

The poorer classes being notorious for the largeness of their families, children will form no inconsiderable proportion of the total inmates. Some of these may be convalescing from Scarlet Fever, or other infectious disease which has not been recognised at home, and others may be incubating infectious diseases of various kinds on admission. The first indication of either of these contingencies may be the occurrence of say, Measles, in the reception house. The greatest care and vigilance has therefore to be exercised by the matron, in frequently scrutinising the children for any sign of infectious disease. Prompt diagnosis, followed by immediate removal to hospital, and the necessary disinfection, will alone prevent the reception house from becoming a danger to its younger inmates.

THE EPIDEMIC INSPECTOR.

Before entering into a description of the disinfection process which takes place after the patient has been removed to hospital, and the "contacts" to the reception-house, it may be well to advert briefly to the duties of the Sanitary Inspector, the official who carries out this part of the work.

The sanitary inspector is to be regarded as the executive officer of the M. O. H. The latter is chiefly charged with devising the various methods of procedure, and the former carries them out. The sanitary inspector is largely concerned with the dis--covery and abatement of nuisances, indeed, under the English Acts, he is termed inspector of nuisances. But he has generally allotted to him various duties in connection with infectious disease.

In a large town like Glasgow, there is the chief sanitary inspector, who has under him a large staff which take up special branches of work. Thus there are the nuisance inspectors, epidemic inspectors, food and drugs inspectors, common lodging-house inspectors, meat inspectors, etc. etc. In addition there is a numerous staff employed in disinfecting. The epidemic inspector, on receiving a notification of infectious disease, proceeds to the house, and takes note of the date of sickening of the patient; names and addresses of contacts; the accommodation for isolation, if any; the milk supply; the latrine accommodation; general state of the house as regards cleanliness and overcrowding; any complaints regarding defective drains, et. etc. It is on his report as a rule, that a case

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of infectious disease is allowed to remain at home or not. He gives directions as to what articles should be disinfected, the rooms to be fumigated, etc., and passes an order to that effect to the disinfecting staff. He makes daily enquiries in an infected tene--ment regarding any suspicion of illness, and reports accordingly. He keeps "contacts" who have not been removed to the reception house, under supervision until the full limit of the incubation period of the disease is past. In twos and threes the epidemic inspectors take up the re-vaccination of people living in infected tenements in the poorer districts, and also in model lodging-houses.

His duties are thus manifold, and demand a considerable amount of ability and discretion for their discharge.

D I S I N F E C T I O N.

During an epidemic of Small-pox the Health Office and the newspapers will be alike deluged by advertising puffs, lauding the efficiency of So and Sb's patent chemical disinfectant. However much the general public may be thus induced to make use of the particular disinfectant, the M.O.H. will adopt a wiser course. In his choice of disinfectants the M. O. H. will do well to reject any patent or secret preparation, and confine his attention to substances of known chemical composition, and ascertained bactericidal potency. To meet the varying circumstances which may arise, he will do well to provide himself with several reliable preparations, both for use in the gaseous and liquid conditions.

The disinfectants should be efficient, yet moderate in price. They should be as far as possible non-poisonous, and should inflict the minimum damage upon the fabrics or surfaces to which they are applied. Their methods of application should be sufficiently simple, so that they can be readily carried out by people of ordinary intelligence and education. Next indeed, to the ascertained bactericidal potency of a disinfectant, is the importance of a knowledge as to the proper method of applying it. The general public frequently purchase the best disinfectants, but fall very far short in their practice of applying them. Thus it is common to find a saucer containing Condy's Fluid in a sick-room, no doubt placed there in the vain hope that the infectious matter, in some unscrutable way, will be attracted to the comparatively small surface of the fluid and be destroyed by its disinfecting action.

After the removal of the patient, the infected clothing is saturated with a 4% solution of Formalin, and afterwards removed to the Wash-house to be thoroughly washed, and all articles which cannot be washed are treated to a process of disinfection by passing through the steam disinfector, or fumigated by means of sulphur or Alformant lamps.

After the removal of the infected clothing, the premises are then fumigated by burning sulphur, in the proportion of 2 lbs. Sulphur to every 1,000 cubic feet contained in the apartment, the exposure to the reagent being at least 4 hours. After fumigation the walls and ceiling are then whitewashed, the white--wash containing ½% solution of Izal.

In some instances, in addition to fumigation, the walls are sprayed with a 4% solution of Formalin, - such as when the walls of the room are papered and the wall-paper not taken off, or where the walls of the apartment in which the case occurred were in a very dirty condition, or where the premises were found to be overcrowded.

The common lobbies and stairs of the tenement are also whitewashed by the disinfecting staff.

The following are the proportions of various disinfectants used by the Glasgow Sanitary Authorities:-

Sulphur, ...	Proportion - 2 lbs. per 1,000 cubic feet.
Formaldehyde, ...	A 4% solution is used for spray--ing.
Izal, ...	½% used in Whitewash.
Carbolic, ...	5% used for washing floors, &c.
Bi-chloride of Mercury,.	1 lb. to 50 gallons of water for saturating clothing, washing woodwork, &c. - 1 in 500 solution.

These methods in daily use, may not conform to the scientific ideal of disinfection, but their practical value is shown by the fact that up to the present, no case of Small-pox has been clearly traced to faulty disinfection.

A possible loophole of escape for the infective matter may arise from some infected articles having been put past in drawers, etc: these receptacles not being interfered with by the disinfectors.

The Small-pox patient having been removed to Hospital, the infected family to the reception-house, and the infected house handed over to the disinfecting staff, steps are now taken to neutralise any infection which may have gone from the infected house into the general community.

Every individual who is known to have been in contact with the patient since his illness began, is visited, warned of the circumstances, and urged to at once protect himself by re-vaccination.

Should the patient, owing to the mildness of the attack, have continued for any time at his work after sickening, a visit is paid to his place of employment, and the co-operation of the employer invited to procure the immediate re-vaccination of the employes who have been associated with the patient.

It is an interesting fact that this appeal rarely fails to be heartily responded to by large employers of labour. As educated men, they recognise the risks which their workmen run, and are keen to appreciate the disastrous effects which might accrue to their business, should it be known that Small-pox has occurred in their factories, etc. The smaller firms, as a rule, fail to display this enlightened spirit, and their help is either refused or given grudgingly. To this unfortunate attitude of mind, there are happily numerous exceptions. When Small-pox has become very prevalent in industrial dis-tricts, many firms have issued notices giving their workers the alternative of consenting to re-vaccination or leaving their employment.

Employers are further invited to send the name

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and address to the M. O. H. of any worker who is absent from work. On receipt of such notice the patient is visited, and if the illness be clearly other than infectious disease, no further steps are taken with regard to him. By this means numerous cases of Small-pox have been brought early to light, with beneficial results alike to the patient, the employer's business, and the public health.

As the reception-house accommodation is bound to be severely strained during an epidemic, it is impossible to remove to it every one known to have been in contact with a Small-pox case, even were it deemed necessary to do so.

The epidemic inspector (whose duties are already described) calls upon all contacts within his district, during a period of not less than fourteen days from their last exposure to infection. He reports at once to the M. O. H. any illness which occurs during this period, and they are medically examined. Frequently the illness reported will prove to be of a non-infectious nature: indeed, many such reports refer to the vaccinal fever which occurs in those who have become re-vaccinated. But a wise M. O. H. will never regret such visits, as not only is it better to err on the side of safety, but the fact that the re-vaccination has proved successful, is no proof that Small-pox may not be about to appear.

THE INFECTED TENEMENT.

The tenement system being a feature of Scottish towns, the occurrence of Small-pox in a family has an important interest to the other inhabitants of the tene-ment. By its common stair and lobbies, sometimes also, as/

as in the poorer districts, by its common latrine accommo-
-dation, and by the comparative close packing of its human contents, the tenement in itself, favours the spread of infection. When a case of Small-pox occurs, the individual families in the tenement are warned of their danger, and advised to be re-vaccinated. As each tene-
-ment dweller has probably come into contact, if not with the patient, at least with some one coming from the infected house, his risk of contracting infection is considerable.

It becomes important therefore, to secure systematic re-vaccination of the population of the infec-
-ted tenement. How is this to be secured? The particular procedure adopted will depend upon the class of tenement.

In respectable districts, the various households can be depended upon to secure the services of their own family doctor, and be re-vaccinated by him. But in the poorer districts a regular medical attendant is the excep-
-tion rather than the rule. Yet it is precisely in such districts that the conditions are more favourable for the spread of the disease, and the necessity for wholesale re-vaccination is the most urgent.

The M. O. H. might be tempted to solve the pro-
-blem by inviting the nearest practitioner to offer re-vacci-
-nation in the tenement, but this would raise several issues

First of all, the practitioner would probably find so much of his valuable time consumed in persuading the people, that he would give up the task in despair. Secondly, he might be personally obnoxious to some of the tenants. Thirdly, and most important of all, his pro-
-fessional brethern in the district might resent this appointment as indicating personal favouritism on part

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of the M. O. H. and as giving the practitioner so appoint-
-ed an introduction to families who generally had other medical attendants.

None of these are fanciful objections; they have all had practical illustrations during the recent epidemic in Glasgow.

The M. O. H. may get out of the difficulty by sending an assistant, but in the height of an epidemic, when such a solution would be most useful, the latter will probably find plenty of more urgent work to occupy his time.

Under these circumstances, it may be advisable to employ a number of young medical men, who will gladly embrace the opportunity of engaging in active work, while waiting on a practice forming. These gentlemen may be sent as required to the different infected tenements in the City, and as they will have no personal connection with the district assigned to them, no objection can be raised by the district practitioners.

But the work will frequently be found to be of a most discouraging nature. Much time and labour are sure to be expended with little re-vaccinations effected. Unless a neighbourhood be thoroughly alarmed by the prevalence of Small-pox, these measures will have but little success. In Glasgow the M. O. H. has had to rely upon his epidemic inspectors to secure the re-vacci-
-nation of an infected tenement, and these men, being well-known in the district, frequently succeed where a stranger would fail.

A tenement in which a case of Small-pox has oc-
-curred is regarded as infected, and the epidemic inspector makes/

makes daily enquiries regarding the health of the tenants for a period of at least fourteen days. Every suspicion of illness is at once reported to the M. O. H. In urging re-vaccination upon the inhabitants of an infected tenement the inspector takes note of all the unvaccinated infants, and impresses upon their parents the need for having the operation at once performed. It is fitting to note here a curious mental attitude exhibited by parents towards infantile vaccination. The law having stated that an infant must be vaccinated within the first six months of its existence, a conviction has unconsciously arisen in the minds of many people, that to vaccinate earlier than six months of age, is dangerous. No doubt the wish to strain the legal period to its utmost limit, may be regarded as the father to this thought, but one has frequently great difficulty, on this account, in persuading parents of the necessity for having the operation done immediately, owing to the infant having been already exposed to infection.

A timely reference to the fact that about six months of age the "teething" troubles (made so much of by young mothers) will be beginning, and that the older the child the more likely he is to vigorously move his gum and thereby not accelerate the healing of the vaccinal sore, will sometimes bring about the desired consent.

There can hardly be imagined a more thankless task, and one demanding a greater display of tact and patience, than that which falls to the lot of the unhappy official who has to argue with, persuade, and even cajole, ignorant, obstinate, and frequently drunken people, to take the most obvious means of preserving their own health.

CAUSES OF FAILURE IN TRACING INFECTION.

One might be tempted to assume that the search-ing enquiries already indicated, into the circumstances of a Small-pox case, would enable the M. O. H. to obtain complete control of any secondary infection from it. But such an assumption would lead to rather a sanguine view of the situation.

No doubt, if complete and accurate information were obtained regarding the persons and objects possibly infected by any given patient, the spread of the disease could be considerably limited. Such an ideal condition of things is, however, never attained, and we may now study some of the circumstances which conduce to failure.

Let us take first of all the simple case of a patient who has been confined to bed since the onset of the illness, until he has been notified as suffering from Small-pox.

With every desire to furnish accurate informa-tion, he may be unable to complete the list of people who have been in contact with him. Defects of memory may cause some names to be omitted, or, if the names be obtained, the addresses may have been forgotten. A certain number of people may thus escape attention, and sickening later of the disease, act as new foci of infection. The other members of the family who have probably continued at work, whilst living in highly infected surroundings, may have spread abroad the germs of disease. No doubt, their fellow workers may be warned, but it is impossible to trace those whom they may have infected in the street, tram-car, railway-trains, etc./

etc. It need hardly be stated, that infection may be conveyed to others although the bearer of the infection is as yet free from the disease.

But it becomes a matter of even greater difficulty when we try to trace the infection distributed by a patient whose mildness of attack has not necessitated confinement to bed and house. Such mild cases are of infinite importance as agents of the spread of infection. Being unrestricted in their movements, they mingle freely with the general public, whilst the odd papule or two which the face may display, will not attract the slightest attention. A single such undetected case may convert what has hitherto been a strictly localised outbreak, into a widespread epidemic. The mildness of the attack in the one case is not the slightest guarantee that those secondarily infected from it will be equally fortunate. Evidence has been abundantly obtained during the recent epidemic in Glasgow, to show how mild undetected cases have given rise to others of the most fatal description.

For example:-

A school-girl had a very mild attack of Small-pox which never attracted attention. Having been thus infected, her sister aged 20 years, who had been vaccina-ted in infancy, developed a somewhat more marked attack of the disease. Even in this instance, however, the illness did not seem to require medical attendance, the patient's mother and herself, attributing it to "the blood being out of order." She therefore continued at work, and when I called as a result of information furnished anonymously, she was about to leave for a dance!

In/

In due time, a companion of hers, and a frequent visitor to her, who was unvaccinated, developed confluent Small--pox, of which she nearly died.

It will be readily admitted then that an extremely modified attack of Small-pox, whilst fortunate for the patient concerned, may be productive of immense danger to the public health.

But imperfect information cannot always be attributed to defective memory on part of the patient or his family, or to circumstances over which they have no control.

It is the common experience of everyone who has been engaged in making such enquiries, that wilful attempts to deceive, which are only too frequently successful, are to be met with. Where any signs of this tendency can be obtained, sometimes the truth may be got at by explaining that no harm is meant to those whose names and addresses are wanted, that on the contrary, the only object is to warn them, so that they may be protected from attack. Amongst the ignorant classes there is not infrequently a vague idea that their friends may be subjected to some form of legal prosecution for having been in contact with infection.

This charitable interpretation of the lying and misleading answers cannot always be maintained, however, and one is forced to the conclusion that there is a certain class who, from sheer perversity, prefer falsehood to truth.

The M. O. H. may fail also in his attempts to locate the various foci of infection, owing to some cases of the disease having been wilfully hidden. This, of course/

course, is subject to penalty under the Infectious Disease (Notification) Act, already referred to, but considerable difficulty is experienced in being able to prove that the offenders were aware of the nature of the disease.

One or two instances of this concealment of disease may be here cited, which are all the more notable as occurring in families that were otherwise highly respectable.

(1) An elderly man called at the Health Office and stated that a daughter had died the previous night of what he feared was Small-pox. As no medical attendant had been called in, although the family circumstances were quite capable of affording such, I at once visited the house. The corpse of a young woman who had evidently died of confluent Small-pox on about the 12th day of illness, was lying in the kitchen bed. On adjourning to a room in order to make enquiries regarding the illness, I found the brother and sister of the deceased both suffering from discrete Small-pox. It seemed incredible that they should have allowed such a violent illness to go on without medical attendance, but no proper explanation was forthcoming. All that could be done was to send the two patients to Hospital, father to the reception-house, and the corpse to the Small-pox Hospital Mortuary.

(2) A note was received from a medical practitioner stating that he had been summoned to a case of Small-pox the previous evening, that the patient had shortly thereafter died, and that he had no medical attendance during his illness.

On/

On visiting the house, the corpse of a con--fluent Small-pox case was found, the illness having apparently lasted about a fortnight. The relatives alleged that they did not know what the disease was, and trusted to his getting better without summoning medical aid. By the irony of fate, apparently, the close of the tenement in which they lived, had displayed for weeks an official notice regarding the prevalence of Small-pox, and advising re-vaccination.

But they had not yet completed the full measure of their transgression. They denied visitors of any description, and said that those present at the time of the official visit were all who had been occupying the house.

Some few days later a young man living in a different quarter of the town developed Small-pox which ultimately proved fatal, having become haemorrhagic. It was found that he had been living in the house with the deceased mentioned, and had only left the day he died.

Within the last few days (16th January, 1902) a third instance has occurred.

A child of 10 years, afterwards found to be unvaccinated, turns ill and is off school. The school board officer is told that she has gone to Ireland. A week or two later, a suspicious neighbour informs the district epidemic inspector who at once institutes enquiries. The mother attempts to pass off a healthy child as the one named by the inspector. He finally gets access to the patient and finds confluent Small-pox. The child has been lying with the disease for fully three weeks, and there are other two unvaccinated children/

children in the house. The mother pleads that she thought the disease was Measles, but it is perfectly apparent that she had at least a shrewd suspicion as to the real nature of the illness.

Another fruitful cause of failure to trace the distribution of infection may arise from the fact that the proximate source of infection is not a person, but an article.

As already alluded to in the chapter on dis--infection, infected articles, not recognised to be such, may escape the disinfecting process altogether. Some of them may, in the general cleaning-up after disin--fection, or at a more remote period, be sold as rags, etc., and thus pass to people who have not been re--vaccinated. Rags are taken as a handy illustration, but it is obvious that any infected article may spread infection.

The greatest cause of failure in limiting the spread of the Small-pox infection is, however, neglect of the practice of vaccination by the general community. Could each individual be rendered proof against infection, the distribution of infective matter would clearly become of trifling importance, so far as that particular community were concerned.

The value and influence of vaccination will, however, be treated somewhat fully in a later section.

MEASURES APPLIED TO THE CITY AS A WHOLE.

Every effort should be made by means of posters, hand-bills, etc., to give public warning regarding the prevalence of the disease, and the necessity for immediate resort to re-vaccination.

Simultaneously with such notice, the Local Authority should take steps to provide re-vaccination. Medical practitioners are paid for each successful re-vaccination above the age of say, 10 years, and the Local Authority provides a pure lymph supply.

It is eminently desirable that these precau-tions should be adopted early in the outbreak, and yet human nature is such, that not until the danger be-comes imminent, will the community be found willing to take advantage of the facilities offered.

Experience has shown that people will delay and delay, always hoping that the disease will not affect their particular district.

Thus, the wife of a patient in the extreme north of Glasgow last year, said that she had been daily looking the papers to see when a case of Small-pox occurred in Springburn. Once that happened, she and her husband intended being re-vaccinated. Unfortunately the first case was in her own household.

Evidence has been repeatedly obtained that whilst re-vaccination will be readily accepted in an infected tenement, the necessity for it will not at all appeal to the inhabitants of tenements in the neighbour-hood. Similarly, house-to-house visitation for the purpose of re-vaccinating a district which has not up till that/

that time, had a case of Small-pox, will prove a complete failure.

With primary vaccinations the Local Authority has at present nothing to do, but, curiously enough, and as indicating the anomalous conditions of legisla-tion, the Local Authority in Scotland, is entitled by Public Health (Scotland) Act, 1897, Section 77, to de-fray the cost of re-vaccination.

The whole question of the administration of the Vaccination Acts will be dealt with in the section on vaccination. (q.v.)

Encouragement of vaccination and re-vaccination is undoubtedly the most valuable weapon which a Local Authority can wield in dealing with an outbreak of Small-pox.

There are various other measures, directed to the attainment and maintenance of a higher standard of sanitation, which, however, must not be neglected, although their influence in suppressing an outbreak is small compared with vaccination.

It is a favourite doctrine with the better classes that cleanliness of person and surroundings will suffice to protect from Small-pox. They regard, therefore, the occurrence of Small-pox in their families as being a reflection on the cleanliness of the house-hold. That there is a grain of truth in this belief no one would venture to deny. Defective hygienic surroundings will unquestionably predispose to infection of any kind, notoriously, however, to Typhus Fever and Plague. The distribution of Typhus Fever in Glasgow or similar large towns, is undoubtedly a valuable guide

to/

to the districts whose sanitary condition is much below par. Typhus and Plague (in the bubonic form) are diseases pre-eminently of dirty quarters; in both the infection seems to have a limited striking distance. Small-pox, however, represents the other extreme. Its striking distance is considerable, and it shews a supreme contempt for mere social distinction, and the degrees of material comfort or the reverse, which these imply.

Cleanliness will no doubt lessen to a slight extent, the chance of infection, but its powers of pro--tection are of small moment compared with those of vaccination.

Still the removal of dirt is always desirable, and especially so during an epidemic of Small-pox, when every waste-heap may contain infected particles.

By the investigation of the Sanitary Inspector and his staff, dirty houses and tenements are brought to light.

Orders are thereupon issued to the tenants and proprietors in terms of the Public Health (Scotland) Act, Sections 40 and 47.

Public Health (Scotland) Act, 1897, Section 40.

"Where it appears to any Local Authority that any house or part thereof, or any article of bedding or clothing therein, is in such a filthy or unwholesome condition that the health of any person is affected or endangered thereby, or that the whitewashing, cleansing or purify--ing of any house or part thereof, or any article of bedding or clothing therein, would tend to prevent or check/

check infectious disease, the Local Authority shall give notice in writing to the owner or occupier of such house or part thereof, to whitewash, cleanse or purify the same, or any such article, as the case may require." (Penalty in default)

Public Health (Scotland) Act, 1897, - Section 47.

"When it appears to the Local Authority, upon the certificate of the medical officer or any other legally qualified medical practitioner, that the cleansing and disinfecting of any house, or part thereof, and of any articles therein likely to retain infection, or the destruction of such articles, would tend to prevent or check any infectious disease, the Local Authority may serve notice on the occupier, or where the house or part thereof is unoccupied on the owner, of such house or part thereof that the same and any such articles will be cleansed and disin-fected, or (as regards the articles) destroyed, by the Local Authority. within a time to be specified in the notice from the receipt of the said notice, that he will cleanse and disinfect the house or part thereof, and any such articles, or destroy such articles, to the satisfaction of the medical officer or of any other legally qualified medical practitioner, as testified by certificate by him, within a time fixed in the notice." (Penalty in default)

Similar powers are bestowed by the Glasgow Police (Amendment) Act, 1880, Sections VII and VIII (q.v.)

The Glasgow Police Act, 1866, Section 254 definitely/

definitely applies similar powers to the whole tene-
-ment: not only are the interior of the dwellings to be whitewashed, but the proprietor is required to treat in a similar manner the outside of the dwellings, the common stairs, lobbies, and staircases.

In addition to the specific examples already given, the law regarding nuisances in general is to be strictly applied. Every little improvement in general sanitation, must evidence somewhat to limiting the disease, although stress should not be laid on that, to the exclusion of the employment of more effective measures, i.e. vaccination.

But an epidemic works a wondrous change, and people in general will show a commendable alacrity at such times in remedying any nuisance which under ordinary circumstances they would be quite indifferent to.

The Local Authority ought certainly to utilise the powerful lever which general fear will place in their hands, to carry out reforms which at other times would meet with active opposition.

In an earlier section of this paper, the fact was alluded to that comparatively few medical practition-
-ers have had experience of Small-pox. It is of the greatest importance therefore, that when an epidemic does occur, the mass of clinical material which it gives rise to, should be made available to the whole medical pro-
-fession of the district.

Clinical demonstrations of the disease at the isolation hospital should be organised, and all practi-
-tioners invited to attend.

The advantage of such a course can hardly be over-estimated, as it will tend to the earlier and more accurate diagnosis of the disease, and thus lead to its speedy limitation and extinction.

One class in particular of the community will require the careful supervision of the M. O. H. during an epidemic of Small-pox, - the migratory population which inhabits farmed-out houses, model and common lodging-houses. These represent the lowest stratum of society, and comprise the idle, vicious and criminal. Owing largely to their vicious and irregular habits they are unable to retain employment for any length of time. Their livelihood is of the most precarious nature, they may be best described as living a hand to mouth existence. Squandering the little they earn largely on drink, they take no thought of the morrow, and their lives are alternately passed in lodging-house poor-house, and prison. Possessing few effects they are not chained to any one locality, but may be constant--ly moving from one low quarter of the town to another. As tramps, they may carry infection from town to town, and many an outbreak has been traced to such origin.

Should a case of Small-pox break out in a "Model", there is apt to be a stampede of the "modellers," as a result. The danger to the community by the scattering of such a crowd of "contacts", is very con--siderable, and it is important to adopt means to pre--vent it. It would be absolutely impossible to trace the movements of individuals whose very names had not been ascertained.

These model lodging-houses are generally large, containing 100 - 800 cubicles.

As it generally happens that the disease is late in being recognised, and owing to the free inter--course of the inmates with each other, the chances of many/

many of them being infected are very considerable. However ample a Local Authority's reception house accommodation might be, it would be swamped by the sudden invasion of several hundred individuals. If then, it be impossible to make the lodgers go to the reception-house, make the reception-house come to the lodgers: i.e. convert the lodging-house into a temporary reception-house. This can be brought about in a very simple manner. The lodgers are offered free re--vaccination, and a week's board, at the cost of the Local Authority. The week's board is the gilding which enables the somewhat bitter pill of the re-vaccination to be swallowed.

By this means the general tendency to scatter is prevented, the 'contacts' are as far as possible protected by re-vaccination, and the week's board keeps them all under one roof so that they can be inspected from day to day.

In carrying out the work of re-vaccination amongst the inmates of a model lodging-house, the success with which it is attended will largely depend upon the active co-operation of the manager and staff.

As a rule, in Glasgow, this has been obtained, but within the last month (January 1902) a striking object lesson has occurred.

A case of Small-pox occurred in a model lodging-house, but the manager being an anti-vaccinator, no re-vaccination of the inmates could be obtained. The Local Authority waited patiently, whilst keeping a sharp look out on the lodging-house. In due time the anti-vaccinating manager and his wife, his chief warder, and/

and now nearly 30 other inmates who refused re-vaccina-
-tion, have all come into hospital with Small-pox.
This is an indication of the facilities offered by the
"Model" life for the spread of infection.

The Local Authority would do well to offer the week's board to all model lodging-houses, irrespec-
-tive of the occurrence of a case in any particular one, as the model lodger shows a tendency to wander from one lodging-house to another. By an agreement with H. M. Prison Commissioners, the Local Authority of Glasgow defrays the expense of the re-vaccination of the short-sentence prisoners. This is a proceeding which is worthy of being copied, as it ensures the vagrant classes being protected at a certain phase of their existence. Those who escape re-vaccination in the models may be subjected to the process in the prison.

In addition to the general measures already alluded to, the Local Authority must make isolation hospital accommodation, adequate to the needs of the district in epidemic condition.

V A C C I N A T I O N.

The enormous value of vaccination as a prophylactic against Small-pox has been apparent to everyone who has had large personal experience of the disease, and it would be an entirely needless piece of labour, at this time of day, and more especially in a University thesis, to seek to prove this fact.

Starting with the well-founded assumption that vaccination is a sine qua non in combatting an outbreak of Small-pox, it is proposed to review the various conditions under which it is practised at the present day.

The Administrative Authorities concerned.

When the Vaccination Acts were being formulated practically the only organised system of local administration was that under the Poor-Law Boards. Sanitary science was in its infancy, and no regular public health service had as yet been formed. Under these circumstances it was only fitting that the duty of carrying out the provisions of the Vaccination Acts should fall upon the only existing form of Local Authority. Since that time, the various Local Government and Public Health Acts have evolved a complete system of representative bodies charged with the care of the public health. But, notwithstanding the immediate relation which the practice of vaccination bears to the public health, no steps have as yet been taken to transfer its administration to those bodies who are better fitted to deal with it. The whole public health service has had as its foundation the Poor-Law Board, and we may regard the present/

present anomalous relegation of the administration of the Vaccination Acts, to the parochial boards, as an interesting relic of the evolution of the Public Health Service.

There is no particular advantage attaching to the present system, whilst the transference of Vaccination measures to the proper authorities, would be of considerable benefit.

A Local Authority would then be able to have an exact and intimate knowledge of the degree to which the community was protected against Small-pox, instead of having to obtain the requisite information in a round about manner.

Lymph and Lymph Supply.

Public vaccinators of large experience are agreed that humanised lymph is generally more active than calf-lymph; that the percentage of insertion - success attained by its use is greater; and that the vesicle produced is more purely a vaccine vesicle, with less tendency to local inflammatory reaction. Immunity against Small-pox, moreover, seems to be obtained earlier when human lymph is employed, being generally complete by the 12th day of vaccination. No doubt the areola formed both after the use of humanised and calf lymph, is in reality due to the extraneous organisms contained in the lymph. These are mainly germs whose normal habitat is the skin of the human subject and calf respectively. The introduction of such germs by inocula-tion is likely to be followed by less irritation in the case whose lymph is derived from the human being, as the cutaneous germs in the lymph are of the same kind as/

as those generally present on the skin. On the other hand,the cutaneous germs of the calf will be more or less foreign to the human tissues, and are more apt therefore to create greater irritation.

The use of calf lymph, however, not only ensures an adequate supply being maintained, but does away with the prejudice against human lymph, namely, that sundry diseases, notably Syphilis, may be transmitt--ed by its use.

So long as the arm-to-arm system of vaccina--tion prevailed, the question of a central lymph-supply did not arise. But now that the use of calf-lymph is the rule, and more especially as the use of glycerised calf-lymph is made obligatory by the Vaccination (Eng.) Act, 1898, it becomes an important matter to study the sources of lymph supply.

At present,the manufacture of calf-lymph is in the hands of private firms, over whom no adequate supervision can be maintained. No doubt, in order to attain commercial success, these manufacturers try to produce the best article possible, But instances are not infrequent in ordinary business, of a firm having achieved deservedly a high reputation, trading upon that,and afterwards producing an inferior article.Further, the commercial basis of the manufacture of vaccinal lymph is not a good one: there is always the temptation to secure increased profit at the expense of efficiency. Glycerised lymph is the order of the day, and one has only to compare lymphs of different "brands" to see how variable the consistency is. This is largely due to the quantity of glycerine added. A fertile source of/

of "weak" lymph is therefore to be found in an undue addition of glycerine, or glycerine and water combined. Instances have not been wanting during the Glasgow epidemic of Small-pox, of marked deterioration in lymph which formerly had a good repute. This was especially noticeable when, under epidemic stress, sudden and large demands were made upon the manufacturer. The inferiority of the lymph was evinced in two ways, first, in a lowered percentage of insertion-success; secondly, in the frequency with which "Bad arms" occurred, during the use of a particular lymph. This led to a bacteriological examination of the various lymphs used, and the following are some of the analyses obtained.

A.

333 Bac. Xerosis.
8 Staph. Albus.
2 " Aureus.
34300 per cc.

B.

537 Bac. Xerosis.
2 Yellow Bac.
1 Bac. Subtilis.
1 Streptothrix.
54300 per c.c.

C.

4 Staph. Aureus.
11 Streptococci.
1668 Bac. Xerosis.
[illegible] germs per c.c.

These were all samples of glycerinised lymph, which, of course, should have been perfectly free from ordinary bacteria when issued to the public.

Fortunately no specific pathogenic organism was found in any lymph examined, nor could any instance of specific pathogenic infection be traced. During an epidemic of Small-pox the reliance placed upon vaccination is considerable, and it is therefore of vital moment that the efficiency and purity of the lymph employed should be above suspicion. If inferior lymph be inadvertently used, the whole value of vaccina-tion is discredited in the eyes of the public, and the Local Authority thereby greatly handicapped in fighting the disease.

The only proper solution of the difficulty is for the Local Government Board to assume the sole right of manufacturing lymph. By this means the purity of the lymph used would be ensured, and a uniform standard of efficiency maintained.

The temptation, from a commercial point of view, to fulfil orders by issuing lymph which had not been properly prepared, stored, and tested, would be entirely obviated.

Efficient Vaccination.

There is a general consensus of opinion which is embodied in the instructions of the Local Government Board to Public Vaccinators, that the maximum efficiency of the vaccinal process is obtained by four or more insertions which yield a combined area, in the vesicular stage of at least one-half square inch.

Whilst therefore, the degree of immunity produced will be fairly uniform so far as those vacci-nated by the Public Vaccinators are concerned, the re-sults obtained in the hands of the general practitioner will/

will be very variable.

There seems to be a widespread belief amongst practitioners, that a small vaccination if successful, will be equally efficacious as a multiple or single large one. This is no doubt due to the fact that the "vaccine" must contain living germs (although the specific ones have not yet been identified) which, in common with all living things, have the power of multiplying. But bacteriology has clearly shown that, up to a certain point, the number as well as the virulence of the germs, stands in a fairly constant ratio to the degree of immunity produced. Not only is the amount of the vaccinal-lymph inserted (roughly measured by the area of skin involved in the operation) of importance, but several separate inser--tions will apparently give a higher degree of immunity than a single one of equal area. In support of this, reference may be made to the researches of Marson, laid before the Royal Commission on Vaccination by Dr. Thorne Thorne, and of Gaytem, Superintendent of the Metropolitan Asylums Board Small-pox Hospital.

The degree of immunity conferred is there shown to stand in relation to the number, size and quality of the vaccinal scars.

Probably the mistaken belief already alluded to, may account for the utterly inefficient performance of vaccination frequently met with, but another cause operates to some extent. Mothers as a rule look upon vaccination as a necessary evil, and whilst obeying the law, they wish in every way to minimise the damage done/

done to the child's arm. They rarely concern them--selves with the question as to whether they are securing the immunity of the child to Small-pox.

With this intention they insist upon the medical attendant putting on only one mark, and try to secure that it is as small as possible. Knowing that if he does not consent to vaccinate as so directed, some others will, the medical practitioner too often yields, and signs a certificate of successful vaccina--tion which is not worth the paper it is written on. Small-pox is frequently far away, and he may comfort himself with the reflection that when the disease appears he can repeat the vaccination. Unfortunately this good resolution is lost sight of, and so another imperfectly protected member is added to the community.

These imperfectly vaccinated infants constitute a few years later, the great proportion of the Small--pox attacks which occur under 10 years. But not only content with producing minimum vaccinations, some practitioners have been found to strain the letter of the law. by signing certificates of successful vaccina--tion where the reaction has been doubtful.

What happens in such a case is shown by the following. Attention was called to a child of 4 years apparently suffering from Measles. There was no possible doubt that the disease was confluent Small-pox in the vesicular stage. Experience having shown the practical impossibility of such occurring so soon after vaccination, I asked the mother why the child had not been vaccinated. She replied that he had been, but close examination of the alleged site, gave no indication

of/

of a mark. Close questioning elicited the fact that the vaccination had been attempted, had not taken properly, but that the "paper" had been signed.

Whilst frankly admitting that multiple marks are best, one has been forced to largely content oneself with securing a single good mark. People as a rule will not have more than one, but efficiency can be secured by making it a large one.

Multiple small marks have certainly the advantage of healing easier than a single large one.

It is greatly to be regretted that the standard laid down by the Local Government Board for the Public Vaccinators, is not obligatory upon the general medical practitioner. If this could be effected, there would be no temptation to the practi-tioner to perform vaccination in the present inefficient manner, as in reply to all persuasions on part of the parent, he could state that the method employed was the only one which would satisfy the requirements of the law.

Whilst engaged in Small-pox work, it has frequently been my lot to come across inefficient vaccination, both primary and re-vaccination. More than once the sole evidence of vaccination performed a day or two before was a single linear incision of about one eighth of an inch. If a vesicle formed, no matter what its dimensions were, the certificate of successful vaccination was given. Small wonder then, that attacks of Small-pox (although generally very mild) are not unknown within 5 years after such successful vaccination.

But/

But ignorance and carelessness in the performance of vaccination is not only evidenced by the small dimensions of the vesicle, or of the scar which results. Another line of evidence justifies only too clearly this apparently harsh condemnation of vaccination as generally practised. The law permits after three unsuccessful attempts at vaccination, a certificate of insusceptibility to vaccinal infection: this alternative certificate being no doubt devised to meet possible instances of idiosyncrasy. The frequency with which such certificates are granted is appalling, in view of the well known fact that actual insusceptibility to vaccination is extremely rare.

This startling discrepancy between the relative frequency of actual and statutory insusceptibility to vaccination, must not be ascribed entirely to inefficiency on part of the vaccinator. Three bona fide attempts may have been made unsuccessfully, and having done so, the practitioner is perfectly justified in signing the certificate of insusceptibility. The fault chiefly lies in the legal definition of insusceptibility. Owing to defective lymph, hot weather or other unfavourable influence, three attempts made within a short time or one another, may all fail, and yet the infant be really susceptible to vaccination.

As a solution of the difficulty one may suggest that the law be amended so as to allow of the following procedure.

After three failures to vaccinate, a certificate/

-ficate of a temporary character should be signed, and sent to the registrar. Such temporary certifi--cates could be revised after six months, and the parents again called upon to secure the vaccination of the child. This delay would at least probably ensure the use of different lymph, and a greater measure of success would be attained. Whatever procedure might be adopted, one thing should at least be secured, namely, that legal and actual susceptibil--ity should be practically synonymous terms. That they are far from being so at present is seen from the following returns.

In the Report of the Medical Officer to the Local Government Board of England, for 1887, Dr. Cory, a Public Vaccinator of vast experience (now dead) makes the following statement regarding "insusceptibility" to vaccination.

"In accordance with your wish that I should record my experience of vaccinating children who have been certified as "insusceptible" I have to inform you that at various times four such cases have been sent to me at Surrey Chapel, and five at Lamb's, Conduit Street, and that in every such case my first attempt at vaccination has succeeded. The resulting vesicles (whether done with human or with calf lymph) have been quite characteristic of vaccine, but eight of them were accelerated in their course in the same way that I have observed after a first unsuc--cessful operation by myself.

Of our own vaccinations, I may say that I have in my time performed over 38,000 primary vaccina--tions/

-tions with human or with calf lymph, and that it has only once fallen to my lot to fail twice at an attempt at vaccination. The subject in this instance was a ten-year-old child, in whom, as stated by its mother, vaccination had been attempted on previous occasions without result. My operation failed at the second attempt, and I did not get the opportunity of trying a third time. I believe the late Dr. Marson has recorded an identical experience from several thousands of operations performed at Black-friars Station, when humanised lymph only was used."

The Report of the Medical Officer to the Local Government Board (England) for the year 1898-99, contains on page IX, the following statement.

"Of 605,887 children on whom vaccination had been performed, as many as 2,885 were certified to be insusceptible of vaccination, that is to say, they had been vaccinated unsuccessfully at least three times. No such case was met with during 1898-99 amongst 3,548 primary vaccinations performed by the Board's operator, and this number being added to the 107,180 similar cases referred to in my last report, gives a total of 110,728 consecutive primary vaccinations performed under the Board's auspices without the occurrence of a single case of so-called insusceptibility."

This large percentage of "insusceptible" certificates is an annual experience.

Dr. Neil Carmichael, the Public Vaccinator for the City of Glasgow, has informed me that in twenty years/

years practice of vaccination he has never had a single case of true insusceptibility. From these reports, it is abundantly evident that the care with which the operation is performed has a marvellous effect in dissipating "insusceptibles."

It is important that the profession generally should bear in mind that in performing vaccination, their efforts should be directed more to securing immunity to Small-pox to the child, than to complying with the letter of the law.

Until a uniformly high standard of vaccina--tion is universally practised, vaccination will always be liable to be mistrusted, and will fall into ill--deserved discredit.

Another source of danger, especially in the face of an epidemic of Small-pox, is the certificate of postponement of vaccination which is apparently rather freely granted by practitioners. No doubt, it is not desirable to add to any child's affliction by insisting on vaccinating during an illness, but there are exceptional circumstances. Whenever there is definite knowledge of exposure to the infection of Small-pox, then, postponement certificate notwithstand--ing, let every such infant be at once vaccinated, unless obviously in a dying condition. The suscepti--bility of the infant to Small-pox is so great, and the mortality of Small-pox under one year is so fright--ful, that almost no condition of health should be allowed to stand in the way of the immediate vaccination of a child living in an infected house or tenement.

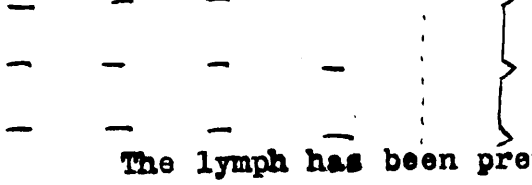
Let us now pass to a brief consideration of the Operation of Vaccination:-

Where at all possible, it is important to secure that the part to be inoculated should be, on general surgical principles, made thoroughly clean. There is, however, no necessity for strict asepsis being aimed at, and certainly antiseptic solutions should be avoided unless they are thoroughly removed before lymph is applied. Excluding those exceptional cases, such as the treatment of naevus, or local practices as in Ireland, where the leg is frequently chosen, the upper arm about the insertion of the deltoid is almost the invariable site.

The instrument used, i.e. (needle, bundle of mounted needles, scarifiers, lancets, etc.,) is of secondary importance. Each individual has his own instrument in the special use of which he becomes expert.

But attention may be called to a method devised by Dr. Neil Carmichael which has certain features to recommend it.

This gentleman uses a blunt lancet, and whilst the skin of the arm is stretched laterally, he makes twelve separate punctures, of sufficient force to split the superficial layers of the epidermis.



The lymph has been previously spread over the area operated upon. After the punctures have been made, the lancet is used like a trowel, and in two sweeps, the lymph is "plastered" into the V shaped pits formed./

formed. When the tension of the skin is relieved, the gaping mouths of the punctures close up and present only lines in their places.

The number of separate punctures made ensures the success of some at least, and as no blood is drawn, not only are the mother's fears allayed, but there is less likelihood of secondary pyogenic infection.

Beyond the confines of a Public Vaccine Station it will be found impossible, however, to get so many separate marks applied. In practice, there--fore,I have been obliged whilst using precisely the same method, to make the punctures closer to each other, so that one large vesicle will form.

This method, in either modification, has the advantage of being rapidly performed, of being highly successful in securing pure vaccine with no pyogenic infection, and of avoiding the drawing of blood, and thus accelerating the process of drying.

There is no need, in this paper, to describe the evolution of the vaccinal inoculation, but some practical hints may be given on the care of the arm after the operation shows signs of being successful.

When the underclothing is clean there is no need of any application to the inoculated part, until the vesicle has properly formed, and even then the only protection required is a mechanical one. This may be best secured by loosely stitching a piece of lint on the inside of the sleeve, just opposite the part. Vaccination shields, which are generally found in any position/

position but the right one, should be avoided. I have seen the tapes of a shield forming two deep circular grooves round the arm, the edge of the shield deeply indenting the arm all round its circumference., and the vaccination itself heaved up like a pie-crust owing to the resultant oedema. Frequently on examination, the edge of the shield will be found "sawing" through the centre of the vaccination and covered with pus and crusts.

Amongst the poorer classes, shields are frequent-ly passed from one family to another, undergoing no cleansing process in the interval: a filthy and dangerous practice.

When the inflammatory process is nearing its height, the arm should be kept as far as possible at rest. At the same and subsequently, to allay the sensation of heat in the part, and to absorb lymph leeting from a partially ruptured vesicle, it may be advisable to dredge the inflamed area with plain powdered starch, oxide of zinc or other bland preparation. When crusting commences it is important to see that the crust is not removed by any cause. Premature detachment is apt to result in pus-formation, with exuberant granula-tion developing, - the healing of the arm being greatly retarded.

A mild laxative after the eighth day or so, may help to counteract the slight disorder of digestion which the vaccinal fever may cause, but its administra-tion before that date does not result, as is popularly supposed, in "sending the pock through the system," for the very obvious reason that the effects of vaccinia are general as well as local.

Delayed Vaccination:-

For some unexplained reason, a vaccination may hang fire for a few days before showing any local alteration: this is more frequently met with when calf lymph is employed, and is probably due to some degree of inertness in the lymph itself. Gentle friction applied to the seat of inoculation will frequently, probably owing to the local congestion which it causes, stir up the flickering fires to a successful issue.

Vaccinal Eruptions.

These are frequently very alarming alike to the adult patient and to the practitioner. Not infrequently, I have found them mistaken for Small-pox itself. They are generally of the urticarial or erythematous type, and are as a rule of short duration. The quality of the lymph is no doubt a factor in their production, but idiosyncrasy is by far the most potent cause. As confirmatory of this the following case may be referred to.

I was asked to see a lad of sixteen who exhibited a peculiar rash. He had been re-vaccinated some ten days before, and presented at the time of visit, a violent urticarial eruption. The mother stated that, about the same time after his infantile vaccination, he had developed an exactly similar eruption.

"Recrudescence" of Vaccinia.

This term was applied by me, in default of a better, to denote a curious phenomenon which came fre-quently under our notice when carrying out re-vaccination. After/

After healing had made some progress, the sore was observed to swell, become oedematous, and appear as if it were about to ulcerate. This yielded in the course of a few days to simple antiseptic dressings, and no untoward developments subsequently occurred. There was not the slightest suspicion of vaccinal Syphilis, and in all probability this appearance was partly due at least to the glycerized lymph.

Re-vaccination.

It is universally admitted that the protection afforded by inefficient vaccination is not continuous, but that the degree of immunity conferred tends to gradually disappear with the lapse of time. As time passes subsequent to successful vaccination, the individual becomes not only susceptible in an increasing degree to Small-pox, but to the vaccinal process itself. How can the present protecting power of a vaccination done in the past, be best estimated?

When a pure uncomplicated vaccination has run its course, a cicatrix results, owing to the destruction of tissue which the inoculation involves. The scar is more or less circular, and after some months has elapsed, is white in colour, and presents numerous shallow pits, so that it is generally termed "foveated." This foveation is distinctive of the vaccinal cicatrix. Should the vaccination have become secondarily infected with pyogenic organisms this typical appearance may be interfered with and even lost. The cicatrix may then be glazed, puckered, and irregular. When there is no evidence of foveation, it is impossible to allege that/

that a particular scar is due to vaccination, whilst it does not exclude the possibility of it having had such an origin. It is not unlikely that in some cases the true vaccination may have failed to take, whilst a local pyogenic infection may have occurred. This may probably be the explanation of some cases of Small--pox occurring in individuals alleged to have been recent--ly vaccinated, and having a scar of this character at the site of the supposed inoculation.

The scar of vaccination is generally permanent, but it may be difficult to discover, especially if the arm be covered with a Small-pox eruption. The scar stands in a fairly constant relation to the area occupied by the vaccine vesicle, and may be therefore taken as a fairly good index, especially when its size and characters are considered, of the efficiency with which the opera--tion had been performed at some antecedent period.

In estimating the efficiency with which vaccination has been performed, we must therefore take into account

(1) the number of scars,

(2) the foveated area.

Whilst in endeavouring to form an estimate of the degree of immunity possessed by a vaccinated individual, we have to add

(3) the length of time which has elapsed since the operation was performed.

In other words, the susceptibility to attack by Small-pox may be roughly gauged by a summary of these three factors.

To aid in the estimation of the area of vaccinal/

vaccinal scars the following rule is in use at the Glasgow Small-pox Hospital[1]

"An approximate collective area of the vaccination scars has been estimated as follows:- A two inch scale marked off in one-tenth inch is applied to the scar, the arm being in a position of rest, and the skin not stretched. Two diameters at right angles to each other are measured, the longer to a tenth inch less than the actual length, the shorter to one tenth-inch more. Eleven-fourteenths of the product of these two readings is regarded as the area of the scar, and is expressed in hundredths of a square inch. Each scar is measured, and the added areas are entered in the column 'collective area'."

As already shown, true, as distinguished from statutory insusceptibility to vaccination is extremely rare, and universal testimony exists that the same is true of susceptibility to Small-pox.

Does the one imply the other? This question can hardly be answered at present owing to the want of exact data regarding the few true insusceptibles to vaccination.

Does susceptibility to vaccination imply susceptibility to Small-pox? Whilst the answer must be, not necessarily, yet it is a good practical rule to assume that it does.

Susceptibility to Vaccination returns earlier than susceptibility to Small-pox after vaccination. Children of three and four years have been found to

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(1) Dr. Birdwood, Met. Asylums Board Report, 1891, p.59.

re-vaccinate successfully, in many instances, although no doubt this age could be considerably raised, were the infantile vaccination in every case a thoroughly efficient one.

In searching the list of Small-pox patients I have only been able to find the following instances of Small-pox occurring within five years after infantile vaccination, however imperfectly performed. Needless to say we have had numerous instances of Small-pox, generally severe, occurring in unvaccinated children under the same age limit,

(1) Age 2 yrs: Infantile Vaccination one mark, 94 sq. inch, not foveated: eruption sparse.

(2) Age 5 yrs: Infantile vaccination doubtful: eruption fairly abundant.

It can be safely said then that susceptibility to vaccination returnsearlier than susceptibility to attack by Small-pox after vaccination. Efficient re-vaccination is undoubtedly called for at ten years of age.

As second attacks of Small-pox occur, (one instance of this is found in the Glasgow Small-pox Hospital records whene a patient comes in with a second attack after a seven years interval), and as the protection afforded by vaccination is less than that given by an attack of Small-pox, it is not surprising to find Small-pox occurring in re-vaccinated people. As no record of the proportion of re-vaccinated adults exists, it is impossible to determine the relative frequency of such an occurrence.

The/

The present epidemic (1900-1902) furnishes us with the following:-

(1) Revaccinated 4 yrs.ago: eruption fairly abundant.
(2) " 6 " 7 spots.
(3) " 17 " sparse eruption. (3 marks)
(4) " 20 "2 marks, very sparse eruption.
(5) " 24 " - fairly abundant.
(6) " 27 " 1 mark. " "
(7) " 28 " - very sparse.
(8) " 31 " 2 re-vaccinations, sparse.
(9) " 32 " 4 re-vac. marks, very sparse.

It will be seen that none of these cases were very severe, and none proved fatal.

Probably re-vaccination after puberty would be more lasting in its effects than before that age, owing to the more settled condition of the tissue--metabolism.

No one who has had experience of Small-pox doubts the urgency for a Re-vaccination Act, and it is to be hoped that the present London epidemic will lead to early legislative action.

One point connected with vaccination seems to have escaped general notice: a patient suffering from Small-pox, and of course also long after his recovery, will <u>not</u> vaccinate or re-vaccinate. Vaccination or re-vaccination may be successful at any point in the incubation period, up till the day of sickening, but not later. This is of great practical importance, as it enables us to decide on cases which it may be impossible to determine clinically. If a patient/

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page 85.

For the words "days after sickening" read "days after vaccination and before sickening of Small-pox," in connection with the Table of Cases.

patient suffering from suspected Small-pox is success--fully vaccinated or re-vaccinated, then his disease is certainly not Small-pox.

How late in the incubation period of Small--pox will re-vaccination, if successful, protect the patient? Cory,[1] quoting Marson, says, assuming the incubation period to be twelve days, and if a person be vaccinated during the first three days, he will escape the disease. If the vaccination be delayed until between the third and fourth days, he would have a modified attack; if the vaccination occurred later, it would have no influence on the attack.

Of 95 persons who were successfully re--vaccinated during their incubation period, the follow--ing is an analysis:

Days after sickening,	0	1	2	3	4	5	6	7	8	9	10	11	12
No. of Cases.	7	3	10	10	14	15	5	14	14	2	1	0	0

A general correspondence was observed between the mildness of the attack, and the length of time which elapsed between the vaccination and the date of sickening.

(1) Theory and Practice of Vaccination, 1898.

OBJECTIONS TO VACCINATION.

Under this heading it is not proposed to enumerate and answer in detail the thousand and one objections which the anti-vaccinating propagandists formulate. To attempt such a task would be entirely a waste of time, as the testimony in favour of vaccination accumulated during many years, is more than enough to convince any fair-minded person. On the other hand, in the course of active work during the Small-pox epidemic, it has been my lot to meet with several general objections to vaccination, which have a reasonable foundation. As an example of the whimsical objections offered, one may cite the following curious one. An individual, living in an infected tenement, refused re-vaccination on the ground that he would run the risk of syphilis by the operation. When this objection was met by the statement that only the best calf-lymph was used, the answer given was well calculated to disturb one's professional gravity. He could not take calf-lymph because he was a vegetarian!

Passing to somewhat more serious and general objections, one may put in the forefront the economical one. The answer frequently met with is, "Who will keep me and my family when I am off work with a sore arm?" This is a serious and cogent objection. It is a grave matter for a working-man to be kept from his work for two or more weeks, and there can be no doubt that a complete re-vaccination will seriously interfere with heavy manual labour. The individual has before him the certainty of a sore arm, and the (to him) very

hypothetical risk of taking Small-pox, or indeed, of him having already been infected.

It is a very difficult matter to convince people that they may be incubating Small-pox, and there--fore may show signs of the disease, whilst at present they feel perfectly well.

One can hardly wonder then, if they decline to submit to a positive ill, in order to avoid a probable or apparently imaginary one.

The duty of the official ends when he has placed fairly before the public the alternative of sub--mitting to re-vaccination, or of running the risk of taking Small-pox. But the consciousness of having scrupulously fulfilled his duty, should not deter him from devising a means whereby this economical loss could be obviated. Unfortunately, the only method which would effect this end, would only ensure the difficulty being overcome in the future, and could not help the present generation.

A re-vaccination, performed in adult life, after primary infantile vaccination, will undoubtedly "take" completely, and inflict a temporary disablement from manual labour. To avoid this, the re-vaccination should be performed at an early age before the suscepti--bility to the inoculation has completely returned. The reaction will be a modified one - the vesicle aborting before it reaches its height, yet the immunity will be brought up to its full measure. This would imply that the operation should be performed every few years, say 7. If in addition to this, efficient vaccination were insisted upon, each time, the frequency with which the operation/

operation would be called for, would be considerably reduced. No one whose work brings him into repeated contact with Small-pox infection, is content to rely upon one successful re-vaccination, however, thoroughly performed. He makes attempts, with various lymphs, every year or two, and as some of these attempts will be attended by a certain measure of success, he keeps his protection up to the high water mark.

Next to the economical objection, is the one which states that the protection afforded is not absolute. That is, of course, perfectly true: and yet it is some--what unreasonable. Whilst not guaranteeing absolute immunity for the rest of life, vaccination is neverthe--less the only prophylactic known, and should therefore be taken advantage of: half a loaf being proverbially bet--ter than no bread at all.

Some base their disbelief in vaccination on the grounds of personal experience. "Mrs. X. was re-vaccinated and yet she took Small-pox in less than a week":- that is a common form of argument. The truth is, of course, that Mrs. X. has been re-vaccinated at a period which is subsequently shown to have been a fairly advanced one in the incubation of the disease. A careful explanation of this apparently paradoxical result, frequently succeeds in convincing waverers.

During an epidemic of Small-pox, while re-vaccination is being actively advocated, the wildest rumours regarding its bad effects will be in constant circulation. At least half a dozen instances of alleged amputated arms came to my personal knowledge, there being of course not the slightest foundation for such rumours/

rumours.

No doubt, untoward effects will occur when vaccinated arms are not properly cared for, but the evils resulting from vaccination have been grossly exaggerated. Mothers especially are only too apt to ascribe to vaccination, all the ills which befall an infant for years afterwards.

Personal testimony will generally be found to weigh far more than any amount of cited authorities, and I have frequently referred to the fact that all of us engaged in dealing with Small-pox, take very good care to be re-vaccinated, knowing well that it is our only protection.

The above are in brief the chief objections to be met with in a Scotch community, where the anti--vaccinator, as yet, has not gained much ground.

Having dealt with the chief objections to vaccination offered by the reasonable individual, we may now consider those maintained by Local Authorities. Either from an utter disbelief in vaccination as a prophylactic against Small-pox, or because they do not think it a necessary one, some Local Authorities propose to deal with a Small-pox outbreak by the ordinary methods of isolation and disinfection. They argue that if the Small-pox patient be at once recognised and isolated, and his former surroundings efficiently disinfected, an outbreak can be speedily repressed. The immediate recognition of the disease in every case, is no doubt a valuable auxiliary in dealing with Small--pox, but such an ideal condition is never fulfilled. Reference has already been made at considerable length

to/

to the frequency with which the disease is wrongly diagnosed, or is wilfully concealed. These considera--tions are sufficient in themselves to show how hopeless it is to combat Small-pox by isolation and disinfection alone. But the enormous difficulties experienced in endeavouring to ascertain all the people who have been exposed to infection from a given case have already been alluded to, so that one has always to be prepared for new cases springing up in the most unexpected quarters. Granting, however, that the case has been at once recognised and isolated, and all the contacts ascertained, two insurmountable obstacles are at once apparent. Apart from vaccination, how is the hospital staff, doctors, nurses, cleaners, ambulance men, disinfectors etc. to be protected against the disease: and failing proper protection of these, how is the isolation to be properly maintained?

The records of any Local Authority will show various employés concerned with infectious disease, to have contracted the disease with which they were working. Thus, nurses, doctors, ambulance drivers, etc. etc. will be stricken down with infectious disease in the course of a single year. Compare that record with that of a properly administered Small-pox Hospital. In Glasgow, it is the rule that every one joining the Sanitary Staff, in any capacity, from office boy upwards, must be re-vaccinated. As a result,no employe has contracted the disease except three,

(1) an old housemaid who kept concealed the fact that she had not been re-vaccinated, and who took Small-pox,-fortunately a mild attack,

(2)/

(2) a house-steward's maidservant, whose re-vaccination was overlooked for a few days: she also took Small-pox.

(3) a housemaid re-vaccinated 6 years before, took a very mild attack of the disease.

The striking feature of a record of infectious disease occurring amongst the employes of an isolation hospital, is the comparative frequency with which nurses and others develop Scarlet Fever, Measles, Enteric, Typhus, Chicken-pox, &c., on the one hand, and the absolute freedom from Small-pox of those engaged in daily work amongst Small-pox cases. This is all the more remarkable when the extraordinary powers of infectivity of Small-pox are borne in mind, and there is, of course, only one possible conclusion, that they owe their immunity to recent successful vaccination. But dismissing for the moment the question of the safety of the Hospital Staff etc. with the brutal remark that they are paid for any risk they run, let us turn to the "contacts." An anti-vaccinating Local Authority professes to confine these rigorously to their houses until the incubation period is passed. Are we to passively await the development of the disease amongst them, as we are unfortunately forced to do in the case of Typhus, or are we to take steps to protect them from the disease? Undoubtedly the only proper course to pursue, is to at once re-vaccinate them. No doubt in some, the prophylactic will come too late to protect from attack, but even in several of this class, it will be in time to modify the severity of the illness. In a large number (see Reception House returns already quoted) it will be found to ward off the attack.

THE ISOLATION HOSPITAL.

When hospitals for the isolation and treat-ment of infectious diseases came into general use, a not unnatural fear arose that the aggregation of infectious cases might have a detrimental effect upon the health of the population in the immediate vicinity of a hospital. An enquiry into this important matter was made by Dr. Thorne, of the English Local Government Board, in 1880-81. The enquiry, whilst accumulating a vast store of information regarding the construction and administration of the isolation hospitals then in use, gave chiefly negative results as regards the influence of the hospital in spreading the disease locally.

"Dr. Thorne, having to tell many a story of hospitals in which the circumstances of site, of con-struction, and of management, might have been better than they were, has nothing to record of fevers, Scarlet, Typhus, Enteric, or other infectious diseases spread from the hospital, as such, to its neighbourhood."*

At the end of 1880 representations were received by the Local Government Board that cases of Small-pox were occurring in an exceptional fashion round certain of the Metropolitan Asylums Board hospitals. A special enquiry was instituted by Mr. Power, and the finding seemed to be that the Fulham Hospital was in-fecting the neighbourhood, in proportion to the proximity to the hospital.

A further extended enquiry was made, and the doctrine at the present day seems to be that Small-pox infection/

* Report by M.O. of Local Government Board, 1882, Supp. 1880-81. Use and influence of Hospitals for Infectious Diseases, page vii.

infection is capable of being conveyed aerially to considerable distances whilst retaining its power of causing the disease.

The latest example (January 1902) appears to be the Small-pox Hospital Ships in the Thames, infecting the neighbouring shores.

It is to be regretted that the vast number of facts accumulated during the epidemic in Glasgow of 1900-1901, and still accumulating, have not at the moment of writing been thoroughly sifted so as to give evidence for or against this doctrine of aerial infection. But it may be worth while alluding to the difficulties which beset such an investigation. If the Small-pox Hospital were situated in the centre of a district which was homogeneous in the density of its population, one great difficulty would be removed. Circles could be drawn at ½ mile radius, with the hospital as a centre, and the density of the population being uniform, the proportion of cases in the various rings could be readily ascertained. From such totals would require to be deducted of course, all cases which whilst residing in hospital area, had been clearly shown to have obtained their infection from a distant source. The difficulty, amounts in many cases to impossibility, of tracing the source of infection in each case, has already been referred to, and hence a more or less erroneous conclusion must be come to.

Unfortunately, the Glasgow Small-pox Hospital is very unfavourably placed for carrying out such a research into its influence in spreading the disease. Not only is it situated at the Eastern Bounadry of the City/

City, but the part of the town adjacent to it is very sparsely and irregularly built upon. (See map annexed). Added to this is the fact that the present epidemic started in the Eastern part of the City, and rapidly spread from its original centre.

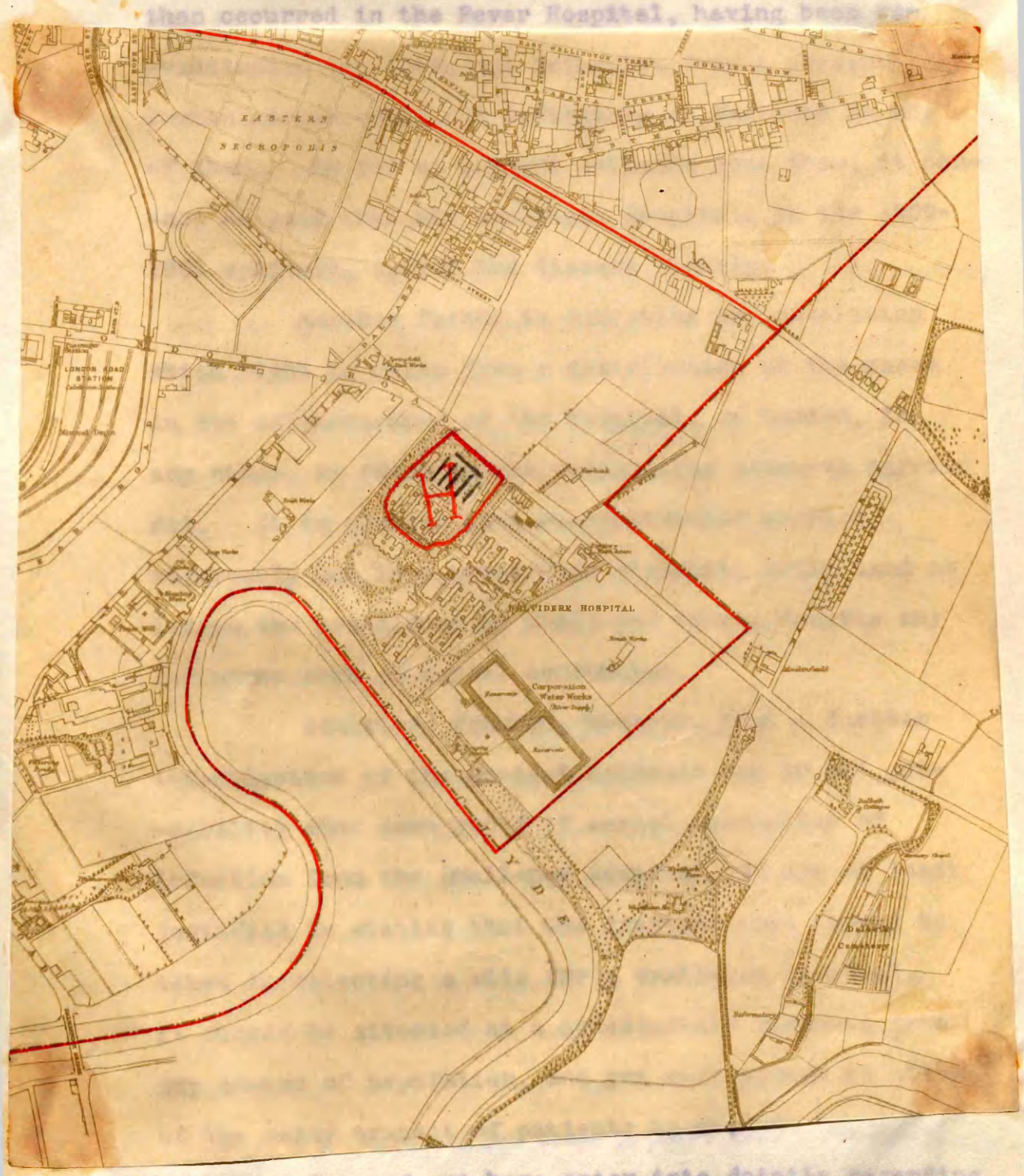
The City, for registration and sanitary purposes is divided into 33 areas, which differ widely in extent and population. It is therefore extremely difficult in describing concentric circles from the hospital as centre, to determine with any approximation to accuracy, the density of the population within each circle. The density of population of each sanitary district is accurately known from the recent Census, but owing to the irregular shape of each area it is impossible to compute the relative proportions lying within each circle.

There can be no doubt that for a long time the extension of the disease was mainly Eastwards from the original focus, along the main street, car routes, etc. Indeed one watched its progress towards the hospital from week to week, so that aerial conviction could not be justified on this ground.

But still, cases did occur all through the epidemic in the scanty population of the newly built-on areas nearest the hospital, and it was impossible to refrain from the conclusion that the hospital did wield an unfavourable influence in spreading the disease locally. Against this, however, must be put the experience of the Fever Hospital which is only separated by a wall from the Small-pox Hospital. So long as the cases in the latter were few, it did not seem advisable to/

Map showing irregular distribution of Houses and therefore of Population in the nieghbourhood of the Glasgow Small-pox Hospital.

The Hospital Boundary is marked in red. H.



to insist on re-vaccinating every patient admitted to the Fever Hospital, - yet none took the disease. Later, however, when the Small-pox cases rose to a considerable number, re-vaccination was carried out in the Fever Hospital. Some five cases of Small-pox then occurred in the Fever Hospital, having been re--vaccinated too late, but infection from a personal communication could not definitely be excluded in any of them. So far as present evidence goes then, it can--not be said that the Small-pox Hospital, in the 1900-1901 epidemic, spread the disease locally.

Another factor in vitiating any conclusion which might be drawn from a distribution of the cases in the neighbourhood of the hospital, or indeed, in any other, is found in the vaccinating measures carried out. It is obvious that re-vaccination carried vigorously out in a particular district, would tend to lessen the prevalence of Small-pox there, despite any influence such as aerial convection.

Admitting frankly, however, that a further investigation of the present epidemic may in all pro--bability show some proof of aerial convection of infection from the Small-pox Hospital, we are at least justified in stating that the greatest care should be taken in selecting a site for a Small-pox Hospital. It should be situated at a considerable distance from any centre of population, and yet near enough to allow of the ready transit of patients to it.

We need not here enter into details regarding the construction and plan of the hospital itself, but it may suffice to point out one or two special pre--cautions/

-cautions that require to be borne in mind in its administration.

All employes, permanent or temporary, should show evidence of recent successful re-vaccination. A recent example of the need for this is to be found in the epidemic of 1901. Over one hundred workmen were engaged in rapidly erecting temporary pavilions to cope with the urgent demand for more hospital accommodation. In spite of the enormous pressure of work on the hospital officials at the time, all but three workmen who evaded the edict, were re-vaccinated, and the three exceptions contracted Small-pox. As these men were working in the open air, and only adjacent to wards containing Small-pox, it shows the necessity for regarding the whole entourage of a Small-pox Hospital as infected. No one who has not been recently re-vaccinated should on any pretext whatever be allowed to enter the precincts of a Small-pox Hospital.

All employes should have ample bathing facilities, and provision should be made for keeping hospital and out-door clothes rigidly apart.

The enquiry-room should be at a considerable distance from the wards, and communication should only be maintained by telephone, no nurses being allowed to come in contact with enquiring friends. All cases, which seem the least doubtful, should be at once re-vaccinated, and this process daily repeated until clear evidence of success is obtained.

The dismissal of a patient from a Small-pox Hospital/

Hospital calls for careful consideration. The period of detention will vary with the individual patient, but none should be dismissed until the skin is entirely clean and free from "cores" or peeling. This will be accelerated by the liberal use of pumice--stone or flesh-brush in the bath, special care being directed to the palms and soles. Beneath the horny epidermis of these parts, the lesions may have become dried and cornified - appearing as little black dots, which can be appreciated by palpation, although they don't project beyond the general surface. These may require to be scraped out individually, but however, they may be treated, none must be present when the patient is dismissed.

When the Small-pox elements have become completely freed from crusts, it will not infrequently be noticed that small secondary crusts appear. This is especially to be met with on the face, the angles of the nose in particular. It is questionable how far these delicate scales are infective, but it is undoubtedly advisable to hasten their disappearance by the use of emollients before the patient is dismissed.

The period of detention in hospital will vary according to the severity of the attack. Recent statistics of the Glasgow Small-pox Hospital, show the following (fatal cases being excluded) duration of illness.

Vaccinated.	Doubtfully Vaccinated.	Unvaccinated
38.3 days.	51 days.	59.6 days.

As the large majority of cases reach Hospital by the 7th day of the illness, the above figures minus 7 days, will give the period of detention in Hospital.

DISPOSAL OF THE DEAD.

The corpse of a Small-pox patient is an undoubted source of danger to the public health, and special measures have to be taken regarding it.

The ideal method of disposal would undoubted--ly be cremation.within the Small-pox Hospital, but public opinion is far from being ripe for such a drastic method. It therefore becomes a question of the precautions to be taken before burial.

The body should be hermetically sealed in a zinc shell, or surrounded in the coffin by quicklime, sawdust impregnated with corrosive sublimate solution, or wrapped in sheets steeped in 4% solution of Formalin. Lately an impervious shroud has been devised, which can be sealed by an adhesive solution, whilst a large pane of celloidin or mica enables relatives to have a last look. The funeral must take place from the Hospital, and the body be taken thence direct to the place of interment, according to the Public Health (Scotland) Act, 1897, Section 63.

> "If a person dies in a hospital or place of temporary accommodation for the sick from any infectious disease, and the medical officer, or any legally qualified medical practitioner, certifies that in his opinion it is desirable, in order to prevent the risk of com--municating such disease or of spreading infection, that the body be not removed from such hospital or place,except for the purpose of being forthwith buried, it shall not be lawful for any person to remove the body except for that purpose; and the body when taken out of such hospital or place, shall be forthwith taken direct to the place of burial and there buried."

GENERAL FEATURES OF THE EPIDEMIC.

It is a very unsafe thing to draw conclusions from observation of an epidemic which is growing, and then which later is interfered with by extensive vaccination. The following are the chief observa--tions.

The quinquennium of life showing the greatest incidence of Small-pox, is the period 25-30 years. This remains true, whatever point in the epidemic be chosen or whether past epidemics are analysed. For purposes of comparison the age constitution of the population is also shown in the accompanying table.

The severe attacks were chiefly met with from 35-40: a man at this age having lost nearly all his protection by the infantile vaccination.

Neither barometric pressure, moisture, velocity of wind, seem to have any direct influence on the disease.

Generally speaking, the disease prevailed more in the cold weather than in the warm, but social influences had a much greater effect, thus:-

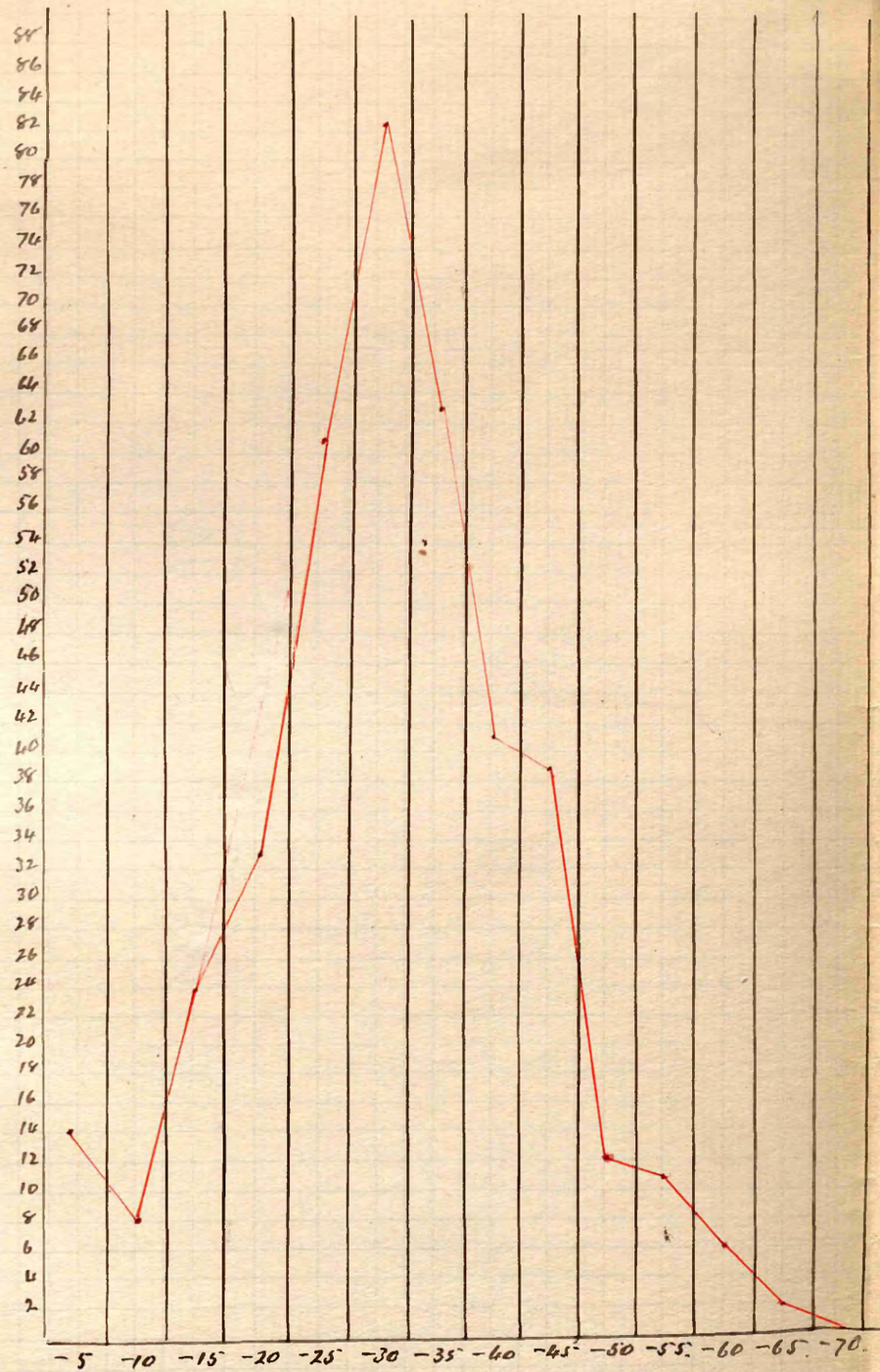
The month of December, 1900, yielded only 71 cases, but January, from the second week onwards, saw a veritable explosion, and the total for the month was well over 400.

The great majority of the cases sickened about a fortnight after the New Year, and no one could reasonably doubt that the great spread of infec--tion was due to the New Year Holidays. At this period/

period, unlike at other holidays, there is a great come and go between friends living in different parts of the town; indeed the populace is mixed up in an extraordinary manner. The result was that many were brought into contact with infection who were safe from it during their ordinary daily life. At this time also the disease was carried to Aberdeen, and other places, by persons from Glasgow sickening while on Holiday. The rapid fall in February, March and April, must be largely attributed to the wholesale re-vaccination which then took place.

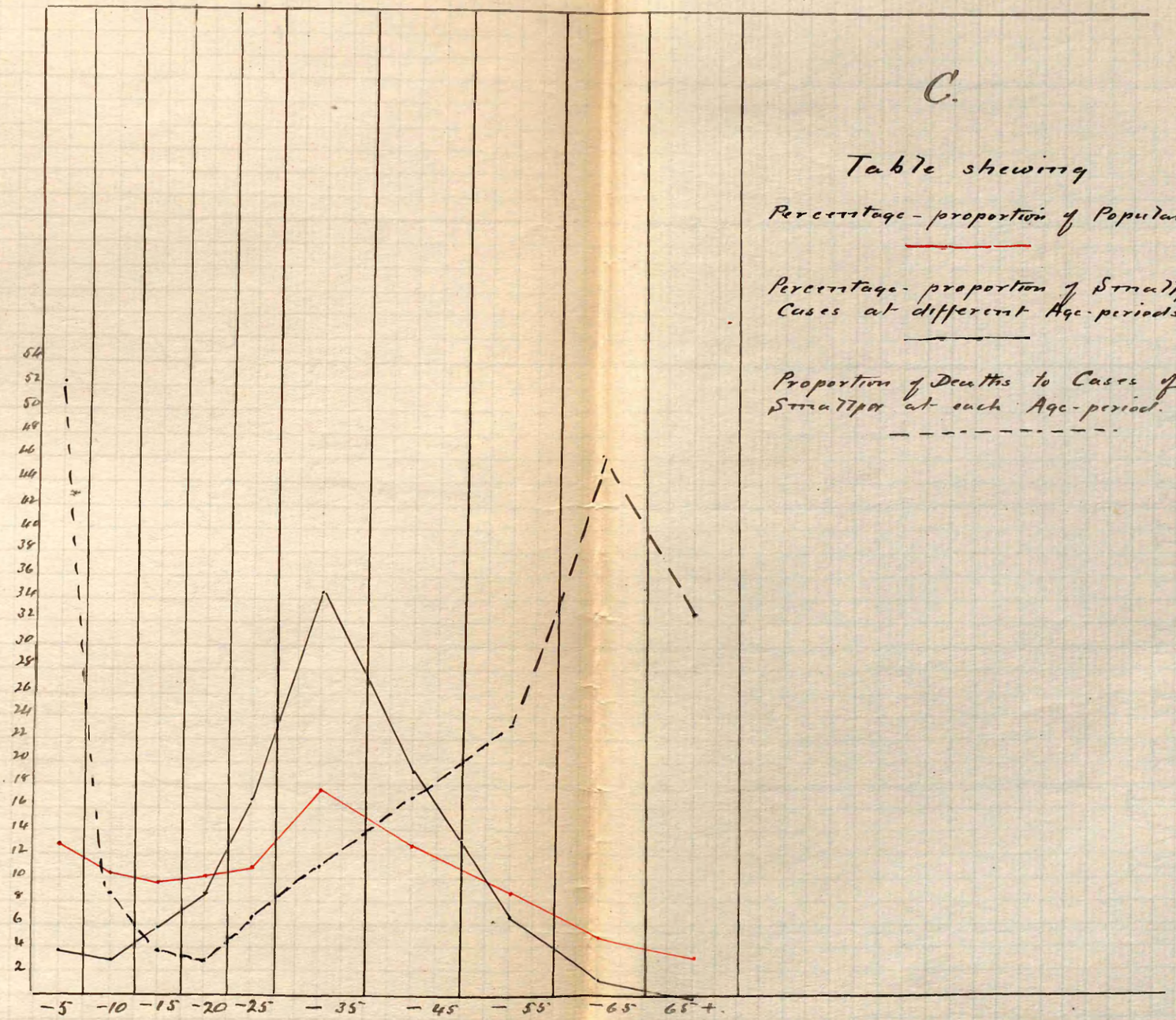
A.

Table shewing fresh cases of Small Pox per month from the beginning of the Epidemic.



B.

Table shewing Age-Incidence in average batch of 400 consecutive Smallpox cases.



C.

Table shewing

Percentage-proportion of Population

Percentage-proportion of Small pox Cases at different Age-periods.

Proportion of Deaths to Cases of Small pox at each Age-period.